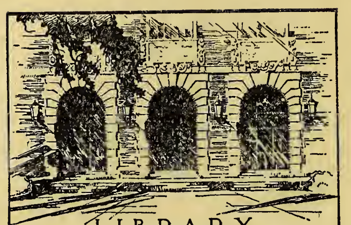

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ANNUAL REPORTS

OF THE

WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1898.

REPORT OF THE

CHIEF OF ENGINEERS.

PART 2.

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UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., July 21, 1898.

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1898.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

H 1.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 877.

Expenditures during the past fiscal year have been applied to the following operations:

1. Examinations at Kinkora Bar, Five Mile Bar, Bulkhead Bar, and Bulkhead Bar Dike.
2. Improvement and survey of Perriwig Bar.
3. Improvement and survey of Cherry Island Flats.
4. Improvement and survey of Dan Baker Shoal and Duck Creek Flats, including improvement of shoal between deep water above Dan Baker Shoal and deep water below Pea Patch Island (off Salem Cove).
5. Repairing the dike on Government reservation at the junction of the Delaware and Schuylkill rivers at Fort Mifflin.

These operations will be described in the above order. The localities referred to and previous operations thereat are described in the Annual Report of the Chief of Engineers for 1896, pages 880–885.

1. EXAMINATIONS.

Kinkora Bar.—A recent examination shows that the channel through this bar has a minimum depth of 8½ feet at low water.

Five Mile Bar.—A recent examination shows that the channel through this bar has a depth of 26 feet at mean low water over its whole width. This bar was dredged in connection with the improvement of Philadelphia Harbor.

Bulkhead Bar.—A recent examination shows that the channel through this bar has a minimum depth of 26 feet at mean low water.

Bulkhead Bar Dike.—The examination was made to determine the extent and cost of proposed repairs to the dike, which will be made during the present season with funds now available.

Improvement and survey of Perriwig Bar.—The river and harbor act of June 3, 1896, required the expenditure of $5,000 from the appropriation for improving Delaware River upon this work. During the fiscal year ending June 30, 1897, an examination was made of the channel dredged in 1895, and it was found to show evidences of shoaling, having a depth of 6 feet at mean low water over a width of from 75 to 200 feet. It was proposed to widen the channel to 200 feet over its entire length, as the shoaled channel was an inconvenience to navigation.

During the past fiscal year operations were in progress under a contract with Percy H. Wilson, of Camden, N. J., dated April 18, 1898, for redredging the channel through this bar, which had shoaled on its sides and axis, to a depth of 6 feet at mean low water over a width of 200 feet. Work under this contract was commenced May 17, 1898, and completed June 29, 1898, a total of 14,500 cubic yards, scow measurement, having been removed, completing the project by the exhaustion of funds. The dredged material was deposited in Biles Creek, behind Biles Island. Surveys were made before the work was commenced and after its completion.

2. IMPROVEMENT AND SURVEY OF CHERRY ISLAND FLATS.

During the fiscal year ending June 30, 1897, a hydrographic survey of this part of the river, extending from Oldmans Point to the mouth of the Christiana River, was made for the purpose of comparison with previous surveys with a view to determining the changes in progress and the effects of improvements.

Under date of September 23, 1896, contract was entered into with the Morris & Cumings Dredging Company, of New York, for dredging the channel on the west side of the flats to a depth of 26 feet at mean low water. Work under this contract was commenced on October 31, 1896, and continued to December 20, 1896, when the dredge was run into and sunk by a steamer. Operations were resumed on April 29, 1897. During the fiscal year ending June 30, 1897, 169,235 cubic yards of material, scow measurement, were removed under this contract.

During the past fiscal year operations were in progress under the above-mentioned contract until November 26, 1897, when the dredge was again run into and badly damaged by a steamer. Further operations by other plant being impracticable, on account of the lateness of the season, the contract was closed on the above date. Three hundred and forty-four thousand two hundred and eight cubic yards, scow measurement, were removed during the year, making the total removed under the contract 513,443 cubic yards. The resulting channel has a low water depth of 26 feet over a width varying from 220 to 265 feet, with a length of 13,600 feet. It is proposed to complete this channel to the width of 400 feet during the present season with funds now available.

3. IMPROVEMENT AND SURVEY OF DAN BAKER SHOAL AND DUCK CREEK FLATS.

During the fiscal year ending June 30, 1897, a survey of Duck Creek Flats was completed.

A Board of officers of the Corps of Engineers was constituted by Special Orders No. 19, Headquarters Corps of Engineers, United States Army, dated July 28, 1896, to consider and report on the project for the dike between Reedy Island and Liston Point, in accordance with the provisions of the river and harbor act of June 3, 1896.

The full report of the Board, dated December 7, 1896, is printed in the report of the Chief of Engineers for 1897, pages 1199–1205.

The recommendations of the Board having been approved by the Secretary of War on December 30, 1896, the adopted project for the improvement of the river was thereby modified so as to provide for the enlargement of the channel from deep water at the head of the bay to deep water above Dan Baker Shoal by dredging instead of by the action of dikes.

Under date of July 31, 1896, the contract of the Delaware Construction Company, of Wilmington, Del., dated November 11, 1895, for the construction and repair of dikes at Reedy Island and Liston Point was annulled by authority of the Secretary of War, and the resulting loss of the contractors was adjusted on August 17, 1896, by the payment to them of the sum of $54,350.35, in accordance with the provisions of the river and harbor act of June 3, 1896.

Under date of February 26, 1897, contract was entered into with the Morris & Cumings Dredging Company, of New York, for dredging a channel with a least depth of 26 feet at mean low water and a least width of 600 feet from deep water at the head of the bay to deep water above Dan Baker Shoal, the quantity of material to be removed during the current season being about 3,000,000 cubic yards, scow measurement. Work under this contract was commenced on April 2, 1897, and at the close of the fiscal year ending June 30, 1897, 756,316 cubic yards, scow measurement, had been removed. Under date of June 18, 1897, this contract was modified by authority of the Chief of Engineers, dated June 4, 1897, so as to provide for the formation of a channel 600 feet wide and 26 feet deep at mean low water from deep water above Dan Baker Shoal to deep water below Pea Patch Island by the removal of about 300,000 cubic yards of material, scow measurement, the work to be done at the same price, and completed on or before June 30, 1898.

During the past fiscal year work was in progress under the above-mentioned contract until December 23, 1897, when it was suspended for the winter season. Operations were resumed March 21, 1898, and are still in progress, a total of 3,069,334 cubic yards, scow measurement, having been removed, making a total to date of 3,825,650 cubic yards, scow measurement.

Under date of December 11, 1897, by the authority of the Chief of Engineers, the amount to be expended under the contract was increased from $300,000 to $340,000, and on March 28, 1898, the project was further modified to provide for a channel 400 feet wide and 26 feet deep at mean low water from deep water above Dan Baker Shoal to deep water below Pea Patch Island, at an additional estimated cost of $45,000, the work to be done at the same price, and completed on or before September 30, 1898.

4. REBUILDING AND ENLARGING DIKE AT FORT MIFFLIN.

The river and harbor act of June 3, 1896, required the expenditure of $3,000 from the appropriation for improving Delaware River upon this work.

Under date of October 7, 1896, contract was entered into with James J. Cowgill, of Paulsboro, N. J., for the required reconstruction and extension. Work under this contract was completed in December, 1896. The dike on the northeastern side of the reservation, extending from high ground at the old Lazaretto for a distance of 1,800 feet along the Schuylkill River front and an additional distance of 300 feet along the Delaware River front, was rebuilt and repaired. The top is now 10 feet above mean low water and has a width of 12 feet. The interior face has a slope of 1 on 2, and the stone revetment on the exterior slope has been relaid and raised to the full height of the dike. A balance of $571.60 remained unexpended.

During the past fiscal year $563.36 of the balance of $571.60 remaining available July 1, 1897, has been expended in repairing about 280 feet of dike along the Delaware River front, by widening the top to 6 feet and relaying the face stone, in renewing a sluice through the short connecting bank between the main bank and the exterior battery of the fort, and in stopping leaks in the main bank.

Up to June 15, 1898, under authorities granted by the Secretary of War, the city of Philadelphia has removed 115,240 cubic yards of rock and other material from Schooner Ledge, and 1,017,780 cubic yards, scow measurement, of material from the channel at Greenwich Point and Mifflin Bar, by dredging, to make a mean low-water depth of 26 feet over a width of 600 feet.

Detailed information with reference to this subject is given in a letter dated June 15, 1898, from Mr. Theo. C. Knauff, secretary of the board of harbor commissioners, city of Philadelphia, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

In view of the large amount of work provided for by the city of Philadelphia and the low prices obtained for dredging in recent contracts, the cost of completing this improvement in accordance with the approved project in addition to funds now available is estimated at $300,000, instead of $805,000 as estimated in the Annual Report of 1896, this estimate being based on the assumption that the city of Philadelphia will complete the channel from the city to the Marcushook ice piers.

During the past fiscal year a survey of the river, made in accordance with the provisions of the river and harbor act of June 3, 1896, was completed from Philadelphia to deep water in the bay, and a project for further improvement submitted January 5, 1898.

The project provides for the formation by dredging and rock removal at Schooner Ledge of a channel 600 feet wide and 30 feet deep at mean low water along the axis of the main ship channel from a point opposite Christian street, Philadelphia, to deep water in the bay, and for rock removal at Petty Island. The total cost of the work is estimated at $5,935,000, on the basis of its execution under a continuous contract within six years after commencement.

The Delaware River is tributary to the following collection districts: Trenton, Philadelphia, Wilmington, and Bridgeton.

The amount of revenue collected in these districts during the year ending December 31, 1897, was $14,057,073.63.

Money statement.

July 1, 1897, balance unexpended		$508, 090. 23
July 30, 1898, amount expended during fiscal year		304, 550. 04
July 1, 1898, balance unexpended		203, 540. 19
July 1, 1898, outstanding liabilities	$47, 685. 73	
July 1, 1898, amount covered by uncompleted contracts	10, 317. 27	
		58, 003. 00
July 1, 1898, balance available		145, 537. 19
Amount (estimated) required for completion of existing project		300, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900		300, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

Act of—		Act of—	
July 4, 1836	$15, 000	August 2, 1882	$286, 000
June 10, 1872	10, 000	July 5, 1884	200, 000
March 3, 1873	115, 000	August 5, 1886	210, 000
June 23, 1874	60, 000	August 11, 1888	250, 000
March 3, 1875	30, 000	September 19, 1890	240, 000
August 14, 1876	40, 000	July 13, 1892	50, 000
June 18, 1878	110, 000	August 18, 1894	170, 000
March 3, 1879	201, 000	June 3, 1896	500, 000
June 14, 1880	235, 000		
March 3, 1881	250, 000	Total	2, 972, 000

Total amount appropriated on present project to June 30, 1898 .... $1, 617, 000

Expenditures.

Total to June 30, 1898	$2, 768, 459. 81
Total on present project to June 30, 1898	1, 413, 468. 05

Abstract of proposals for dredging in the channel of the Delaware River through Perriwig Bar, opened April 11, 1898, by Maj. C. W. Raymond, Corps of Engineers.

[Approximate quantity of material to be removed, 15,000 cubic yards.]

No.	Name and address of bidder.	Per cubic yard.	Amount.
		Cents.	
1	Percy H. Wilson, Camden, N. J.	30	$4, 500
2	American Dredging Co., Philadelphia, Pa	35	5, 250

Contract (dated April 18, 1898) entered into with Percy H. Wilson.

LIST OF ALL CONTRACTS IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

1. With Morris & Cumings Dredging Company, of New York, for dredging in channel of river through Dan Baker Shoal and Duck Creek Flats, dated February 26, 1897, and approved March 22, 1897. Work to be commenced on or before April 1, 1897, and be completed on or before December 31, 1897. Supplemental articles of agreement, increasing quantity of material to be dredged, entered into June 18, 1897, and approved by Chief of Engineers, United States Army, June 26, and by the Secretary of War July 7, 1897. The additional work to be completed on or before June 30, 1897. Under date of December 11, 1897, by authority of the Chief of Engineers the amount to be expended under the contract was increased from $300,000 to $340,000. Supplemental articles of agreement, increasing quantity to be dredged, entered into April 2, 1898, and approved by the Chief of Engineers, United States Army, April 13, 1898, and by the Secretary of War on April 18, 1898. The additional work to be completed on or before September 30, 1898.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River, for the years ending December 31, 1896 and 1897, are compiled from reports of the Board of Trade, the Commercial Exchange, and the Maritime Exchange of the city of Philadelphia.

Articles.	1896.	1897.
IMPORTS.	*Tons.*	*Tons.*
Asphalt and asphalt blocks	10, 361	12, 508
Burlaps	9, 771	12, 337
Cement	43, 071	37, 795
Chalk	29, 800	22, 546
Clay	15, 426	19, 198
Coal	5, 658	130
Coal tar, and pitch of	817	1, 354
Cork and cork wood	438	952
Cotton and cotton fabrics	2, 032	2, 349
Drugs and chemicals	71, 831	80, 310
Earthenware, china and stoneware	222	172
Fertilizers	4, 977	9, 327
Fruits	13, 283	9, 716
Glass, and manufactures of	989	928
Glue and glue stock	416	497
Groceries and provisions	6, 067	6, 550
Hair, and manufactures of	505	951
Hemp, jute, flax, and their fabrics	21, 310	20, 500
Hides and skins	3, 452	4, 731
Iron, manufactures of	5, 560	3, 497
Iron, ore	308, 217	194, 814
Iron, pig	5, 521	3, 035
Iron, scrap	699	255
Leather, and manufactures of	174	195
Live stock and fowls	40	56
Mineral water	579	1, 037
Oil	1, 546	1, 924
Ores, metals, and manufactures of	17, 534	128, 559
Plants and seeds	1, 739	1, 260
Plaster of paris	25, 974	17, 806
Rags	946	378
Salt	20, 929	14, 207
Silk, and manufactures of	92	121
Stone, and manufactures of	5, 031	3, 419
Sugar	395, 774	452, 726
Molasses	2, 612	377
Sulphur, crude	7, 685	5, 531
Sulphur, ore	52, 944	53, 623
Tin	13, 972	12, 342
Tobacco	375	218
Wines and liquors	1, 209	1, 308
Wood pulp, paper, and manufactures of	23, 916	19, 879
IMPORTS—continued.	*Tons.*	*Tons.*
Wood, and manufactures of	5, 722	4, 479
Wool and wool fabrics	8, 861	16, 373
Miscellaneous	3, 643	2, 537
Total	1, 148, 720	1, 182, 807
EXPORTS.		
Beef, pork, and products	33, 217	33, 711
Cars and locomotives	6, 265	2, 155
Coal	338, 250	402, 134
Corn and corn meal	247, 445	705, 868
Cotton and cotton fabrics	3, 199	4, 459
Drugs and chemicals	2, 271	3, 350
Fertilizers	646	671
Flour	91, 837	86, 409
Glucose	4, 014	9, 887
Glue and glue stock	26	57
Groceries and provisions	4, 958	8, 677
Gunpowder and explosives	....	426
Hay	134	745
Hides, leather, and manufactures of	1, 350	921
Iron, manufactured	4, 989	13, 039
Iron, pig	....	3, 386
Iron, scrap	....	2, 151
Live stock	7, 030	6, 676
Metals, other, and manufactures of	251	478
Molasses	7, 956	18, 733
Oats and oatmeal	8, 142	40, 093
Oil cake	39, 440	32, 892
Oils, lubricating	37, 503	32, 044
Oils, other	282	136
Paraffin	9, 236	13, 358
Petroleum, crude and refined	842, 697	990, 796
Seeds	172	519
Soap, tallow, and grease	4, 259	4, 630
Tobacco	7, 417	5, 666
Wheat	145, 916	144, 048
Wines and liquors	39	10
Wood and manufactures of	18, 339	27, 793
Miscellaneous	7, 801	4, 044
Total	1, 875, 081	2, 599, 952

Passengers arriving from and departing for foreign countries.

	1896.	1897.
Arriving	21,920	12, 644
Departing	7,811	8, 118
Total	29, 731	20, 762

Comparative statement of tons and values of exports, imports, and revenue collected.

Year.	Exports.		Imports.		Revenue.
	Tons.	Value.	Tons.	Value.	
1891	1, 540, 966	$42, 845, 724	1, 381, 870	$62, 438, 219	$11, 121, 320
1892	2, 359, 155	60, 274, 024	1, 429, 636	63, 277, 781	10, 886, 475
1893	1, 816, 297	43, 416, 955	1, 154, 814	58, 870, 186	9, 899. 284
1894	1, 861, 578	37, 441, 000	1, 164, 572	51, 553, 704	8, 456, 183
1895	1, 738, 913	36, 745, 119	1, 355, 456	47, 271, 435	13, 526, 966
1896	1, 875, 081	42, 431, 100	1, 151, 722	39, 807, 278	12, 657, 803
1897	2, 599, 952	51, 760, 616	1, 182, 807	27, 921, 738	14, 057, 074

Foreign entrances and clearances.

Class.	Entered from foreign ports.				Cleared for foreign ports.				Total.	
	With cargoes.		In ballast.		With cargoes.		In ballast.			
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
American steam vessels	33	69, 796	1	626	26	58, 435	3	1, 878	63	130, 735
American sail vessels	118	62, 448	3	2, 176	137	74, 786	4	1, 954	262	141, 364
Foreign steam vessels	454	784, 560	304	551, 123	647	1, 177, 717	74	65, 605	1, 479	2, 579, 005
Foreign sail vessels	89	80, 151	59	74, 930	137	150, 574	5	5, 802	290	311, 457
Total	694	996, 955	367	628, 855	947	1, 461, 512	86	75, 239	2, 094	3, 162, 561

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1896 and 1897, has been compiled from returns made to this office by shippers, consignees and carriers:

Articles.	1896.		1897.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Brick and terra cotta	50, 705	$174, 900	12, 828	$40, 132
Cement and plaster	36, 261	131, 229	27, 190	103, 754
Chemicals	78, 121	1, 313, 962	125, 186	2, 268, 324
Coal	1, 183, 694	4, 117, 418	1, 232, 659	3, 825, 035
Cotton	8, 245	1, 317, 300	8, 227	935, 755
Fertilizers	64, 983	927, 749	64, 534	874, 502
Grain	19, 920	457, 207	25, 795	751, 775
Hay	6, 261	53, 161	10, 906	58, 593
Ice	368, 894	729, 496	294, 137	514, 266
Iron:				
Manufactured	74, 126	2, 204, 211	116, 626	3, 442, 602
Pig	174, 069	1, 946, 963	150, 060	1, 605, 950
Scrap	1, 145	23, 969	2, 706	24, 586
Lumber	538, 715	3, 501, 345	769, 218	4, 722, 070
Oysters and fish	24, 125	670, 380	22, 917	777, 342
Petroleum and products	144, 866	2, 411, 718	10, 409	198, 919
Produce and fruit	138, 601	1, 395, 134	62, 825	1, 032, 365
Railroad ties	94, 431	452, 158	268, 497	1, 334, 578
Sand	940, 227	763, 007	1, 056, 978	689, 187
Stone:				
Building	99, 217	305, 861	27, 217	235, 027
Paving	37, 904	109, 036	70, 223	120, 716
Sugar	170	10, 630	....	....
Wood, cord	107, 314	418, 281	75, 701	307, 068
Miscellaneous	1, 356, 015	239, 633, 125	1, 455, 875	243, 497, 529
Total	5, 548, 009	263, 068, 240	5, 890, 714	267, 360, 075

Articles.	1896.		1897.	
	Tons.	Value.	Tons.	Value.
DEPARTING.				
Brick	22, 953	$104, 704	8, 172	$51, 479
Chemicals	22, 927	1, 640, 126	28, 492	2, 239, 863
Coal	4, 890, 790	17, 196, 019	5, 873, 680	17, 668, 281
Cotton	7, 339	1, 059, 780	12, 962	1, 734, 980
Fertilizers	68, 247	1, 485, 653	59, 797	1, 206, 723
Grain	3, 450	66, 992	8, 786	182, 780
Hay	355	3, 375	1, 000	6, 000
Ice	500	1, 000	300	600
Iron:				
Manufactured	142, 699	4, 230, 789	159, 682	3, 975, 530
Pig	37, 782	415, 602	29, 998	329, 843
Lumber	31, 894	371, 926	45, 029	260, 705
Manure	157, 157	239, 029	136, 603	161, 946
Petroleum	139, 804	2, 047, 332	450, 745	8, 337, 714
Produce	6, 175	225, 405	375	37, 500
Sand	13, 592	16, 590	15, 694	15, 411
Stone, building	326	5, 410	176, 542	262, 413
Sugar	3, 394	271, 520	....	....
Miscellaneous	1, 144, 169	249, 208, 623	1, 342, 158	244, 002, 789
Total	6, 693, 553	278, 589, 875	8, 350, 015	280, 474, 557

Passengers arriving at and departing from Philadelphia.

	1896.	1897.
Arriving	1, 202, 324	1, 098, 599
Departing	1, 207, 239	1, 112, 588
Total	2, 409, 563	2, 211, 187

Domestic and coastwise arrivals and departures in cargo.

Class.	1896.		1897.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers	*a* 15, 838	*a* 20, 243	*a* 13, 364	*a* 13, 422
Sailing vessels	5, 549	5, 885	4, 773	5, 712
Canal boats and barges	17, 980	21, 136	*b* 24, 334	*c* 25, 028
Rafts	25	93	19	182
Total	39, 392	47, 357	42, 490	44, 364

a Excluding tugboats and ferryboats. *b* Including 4,839 railroad lighters.
c Including 4,816 railroad lighters.

SUMMARY.

Freight movement.

	1896.		1897.	
	Tons.	Value.	Tons.	Value.
Foreign:				
Arriving	1, 148, 720	$39, 807, 278	1, 182, 807	$27, 921, 738
Departing	1, 875, 081	42, 431, 100	2, 599, 952	51, 760, 616
Domestic:				
Arriving	5, 548, 009	263, 068, 240	5, 890, 714	267, 360, 075
Departing	6, 693, 553	278, 589, 875	8, 350, 015	280, 474, 557
Total	15, 265, 363	623, 896, 493	18, 023, 488	627, 516, 986

Vessel movement.

	1896.	1897.
Steam vessels, foreign trade, arriving	700	792
Sailing vessels, foreign trade, arriving	243	269
Steam vessels, foreign trade, departing	629	750
Sailing vessels, foreign trade, departing	259	283
Steam vessels, domestic trade, arriving	15, 838	13, 364
Sailing vessels, domestic trade, arriving	5, 549	4, 773
Canal boats and barges, domestic trade, arriving	17, 980	24, 334
Rafts, domestic trade, arriving	25	19
Steam vessels, domestic trade, departing	20, 243	13, 422
Sailing vessels, domestic trade, departing	5, 885	5, 712
Canal boats and barges, domestic trade, departing	21, 136	25, 028
Rafts, domestic trade, departing	93	182
Total	88, 580	88, 928

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE PROGRESS MADE BY THE CITY OF PHILADELPHIA IN THE WORK OF IMPROVING DELAWARE RIVER, DURING THE FISCAL YEAR ENDING JUNE 30, 1898, WITH ONE INCLOSURE.

Board of Harbor Commissioners for the City of Philadelphia,
Philadelphia, Pa., June 28, 1898.

Sir: I beg to acknowledge the receipt of your communication under date of June 4, 1898, in which you ask to be furnished with a concise statement of what has been accomplished by the city of Philadelphia since June 30, 1897, in the improvement of the Delaware and Schuylkill rivers and the harbor of Philadelphia.

Under the head of the improvement of the Delaware River I would report that work by the city has been continued under contract No. 1, mention of which was made in the report of last year, for the removal of rock from the main Schooner Ledge and Illinois Rock. At the present time, after the removal of the overlying material, before reported, 9,100 cubic yards of rock have been removed from Illinois Rock, blasting being carried to 27 feet in order to insure a depth of 26 feet at mean low water over the area.

On Schooner Ledge, main portion, 9,500 cubic yards of rock have been removed to the same depth. To clear the channel of bowlders and pieces of ledge thrown up in the process, considerable blasting and dredging remain to be done.

Under contract No. 5, which was an extension of contract No. 1, and was for additional work on the north end of Schooner Ledge, some 1,640 cubic yards of rock have been removed and the contract virtually completed, although no final estimate has yet been given. The highest points of the ledge have been removed under this contract and the solid material which was removed under both contracts, after being broken up into proper sizes, has been dumped on the site of the new piers on the Delaware Harbor for the proper support of the piles, and also behind Chester Island.

Under contract No. 6, which had not gone into effect at the last report, good progress has been made. The greater portion of the middle-ground has been removed, making a least channel width of 1,400 feet between the curves of 26 feet below low water.

The work on Fort Mifflin Bar is nearing completion, but as yet no work has been done under this contract along Schooner Ledge Range.

From Greenwich Point 888,143 cubic yards have been removed and 129,637 cubic yards from Fort Mifflin Bar, or a total of 1,017,780 cubic yards, which has all been placed on Mud Island, at the junction of the Delaware and Schuylkill rivers.

For the statement of the details of these contracts and of the work done under them, I am indebted to Mr. George S. Webster, chief engineer and surveyor of the city of Philadelphia, a copy of whose communication, marked A, is herewith inclosed.

Yours truly,

Theo. C. Knauff, *Secretary.*

Lieut. Col. C. W. Raymond,
Corps of Engineers.

INCLOSURE A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, Pa., June 15, 1898.

DEAR SIR: In reply to your communication of the 6th instant, requesting a statement upon the improvement of the Delaware River, carried on by the city of Philadelphia, I report as follows:

Contract No. 1.—Consists of the removal of ledge rock and overlying material on Schooner Ledge Range, opposite Chester, Pa. Appropriation, December 28, 1894. Contractor, The Philadelphia Public Works Company. Date of contract, December 10, 1895. Limit of contract, $175,000. Contract supplemented March 22, 1897, by an additional appropriation of $125,000, making a total limit of $300,000.

Prior to the blasting of the ledge rock the overlying material was removed to the amount of 95,000 cubic yards, both from the main Schooner Ledge and Illinois Rock, within the limits of a 600-foot-wide channel. After the removal of the overlying material soundings were made to determine the top of the rock.

The drilling has been done by hydraulic and steam power from a large drill boat, and the rock broken up by the use of dynamite. After being dredged and broken up to specified sizes, the rock has been dumped on the site of the piers in the Delaware River opposite the city of Philadelphia, for the proper support of the piles, and also behind Chester Island.

About 9,100 cubic yards of rock, place measurement, have been removed from Illinois Rock, blasting being carried to 27 feet, in order to insure a depth of 26 feet of water at mean low tide over its area.

From the main portion of Schooner Ledge 9,500 cubic yards of rock have been removed to a corresponding depth, but considerable drilling and dredging is yet to be done to clear the channel of bowlders and pieces of ledge which have been thrown up in the operation of blasting and dredging.

Contract No. 5.—Consists of removing several small ledges on the north end of Schooner Ledge, and joins the work being done under contract No. 1. Work was authorized April 13, 1896. Contractor, H. T. Dunbar & Co. Date of contract, June 3, 1897. Amount of contract, $28,000.

In all about 1,640 cubic yards have been removed and the contract is practically completed, although final estimate has not yet been given.

The highest points on Schooner Ledge were removed under this contract. Material was deposited at the same points as in contract No. 1.

Contract No. 6.—This work consists, first, of removing what is known as the middle-ground in the Delaware River, opposite Greenwich Point coal wharves, extending between the prolongation of Avenue 38 south and the prolongation of Morris street, which is the southern limit of the Philadelphia Harbor improvement. Second, dredging a channel across Fort Mifflin Bar. Third, the removal of shoals along Schooner Ledge Range.

Work was authorized April 13, 1896. Contractor, The American Dredging Company. Date of contract, June 3, 1897. Amount of contract, $315,000.

Since work was begun in July last, the progress has been such that the greater portion of the middle-ground has been removed, making a least channel width of 1,400 feet between the curves of 26 feet below low water.

Work has also been carried along on Fort Mifflin Bar, and is nearing completion at this point. No work has yet been done along Schooner Ledge Range under this contract.

There has been removed from Greenwich Point 888,143 cubic yards, and from Fort Mifflin Bar 129,637 cubic yards, or a total of 1,017,780 cubic yards of material, measured in scows, and placed on Mud Island, at the junction of the Schuylkill and Delaware rivers.

Date.	Description.	Amount.
Dec. 28, 1894	Allotment for removing impediments to navigation	$185,000
Apr. 13, 1896	Improving channel of Delaware River (loan)	500,000
	Total	685,000

Yours truly,

GEO. S. WEBSTER, *Chief Engineer.*

MR. THEODORE C. KNAUFF,
Secretary, Board of Harbor Commissioners.

H 2.

IMPROVEMENT OF HARBOR BETWEEN PHILADELPHIA, PENNSYLVANIA, AND CAMDEN, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 897.

During the past fiscal year, under a contract with the American Dredging Company, dated June 1, 1893, 2,978,295 cubic yards of material, scow measurement, were excavated from the harbor. The contract above referred to was completed January 10, 1898, 20,799,349 cubic yards, scow measurement, having been dredged from the channel, from Smith and Windmill islands and the adjacent shoals, and from a part of Petty Island, of which 2,970,118 cubic yards, scow measurement, were deposited and spread on League Island, and 17,023 linear feet of revetment removed, at a cost of $3,468,354.34, including inspection and superintendence.

The total amount of work accomplished to June 30, 1898, is as follows:

Material removed by dredging, scow measurement	cubic yards	21,605,061
Piling and revetment removed	linear feet	24,848
Dredged material deposited and spread on League Island, scow measurement	cubic yards	3,585,082

The following results have been obtained: The channel has been dredged to the full depth of 26 feet from Morris street to the Pennsylvania Railroad Bridge at Fishers Point, 6.2 miles, except at one locality where ledge rock was discovered during the progress of the work. This rock is in the upper part of the harbor, opposite Rush street, and just below Cramps' shipyard. The least depth over it is 18.8 feet and the average depth 23 feet at mean low water. There is a channel having a least depth of 26 feet and a least width of 650 feet between the rock and the heads of existing piers. The removal of solid rock found in the channel was not provided for in the contract for dredging. Within the limits of the improvement, except at the locality above mentioned, the width of the 26-foot channel varies from 1,015 feet to 1,850 feet.

Smith and Windmill islands have been removed to an average depth of 26 feet at low water, the northern side of Petty Island has been dredged back to the New Jersey pierhead and bulkhead line, giving a low-water width of 1,900 feet to the Pennsylvania channel at that locality; all the pile and stone revetments have been removed, and the filling of spaces on League Island, as provided for in the contract, completed. About 133 acres of land formerly above low water have been removed and 374 acres formerly below high water have been raised above high water. The data required for the execution of the work and the determination of its effects and changes have been obtained from detailed daily hydrographic examinations and surveys, based on a rigid system of triangles and range lines marked by natural objects, covering the entire distance from Fishers Point to Kaighn Point, 6½ miles. Tidal observations are registered by an automatic gauge at Pier 54, south.

Surveys and examinations made during the past fiscal year show that the increased depth has been well maintained, no shoaling having been found within the limits of the improved channel, except along the face of Petty Island and above Erie avenue, where the wharves have not yet been extended to the new pierhead line.

The shoal near Cooper Point, outside the limits of the 26-foot channel 1,000 feet wide along the revised Philadelphia wharf line, due to the conflict of tides at the foot of Petty Island, still remains; no permanent improvement at this point can be expected until the channel south of Petty Island has been closed by the extension of Fishers Point Dike.

On February 3, 1898, after the completion of the dredging, a project was approved for the expenditure of $11,200 in making a survey of the harbor, including gaugings of flow and determination of velocities, measurements of dumps, repair of plant, preparation of maps and engineering expenses and contingencies, supplementing the completion of the widening of the channels between Philadelphia and Camden, and north of Petty Island by dredging. Work under this project is now in progress. The funds now available are considered sufficient to complete the work.

During the past fiscal year six piers, including four previously commenced, were extended fully to the new line, and permission was given by the board of port wardens for the extension of seven others. Five are now under construction.

Up to June 30, 1898, 17 wharves between Ann street and Queen street, on the Philadelphia front, have been extended to the new pierhead line, and between Pearl and Mickle streets, Camden, five wharves have been similarly extended to the New Jersey pierhead line.

The city of Philadelphia is now constructing along the new bulkhead line, from Vine to South streets, a bulkhead which, when completed, will permit the widening of Delaware avenue at that locality to 150 feet.

Detailed information with reference to these subjects is given in a letter dated June 28, 1898, from Mr. Theo. C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

The accompanying sketch shows the condition of the channel after the completion of the improvement, January 10, 1898.

The commercial statistics pertaining to this work are included in the statistics accompanying the report for the improvement of Delaware River.

This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1897, revenue to the amount of $14,042,298.63.

The nearest fort and light-houses are, respectively, Fort Mifflin and Upper Horseshoe range lights.

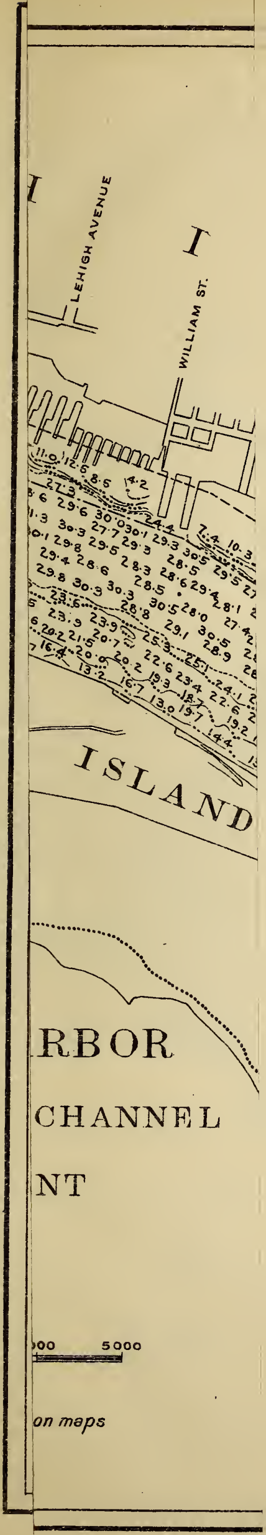
Money statement.

July 1, 1897, balance unexpended	$800, 531. 23
June 30, 1898, amount expended during fiscal year	798, 127. 17
July 1, 1898, balance unexpended	2, 404. 06
July 1, 1898, outstanding liabilities	300. 00
July 1, 1898, balance available	2, 104. 06

Appropriations.

Act of—		Act of—	
August 11, 1888	$500, 000	March 2, 1895	$850, 000
September 19, 1890	200, 000	June 11, 1896	600, 000
March 3, 1891	300, 000	June 4, 1897	694, 000
August 5, 1892	41, 000		
March 3, 1893	500, 000	Total	3, 935, 000
August 18, 1894	250, 000		

Total appropriations for part payment for land	300, 000
Total appropriations under present project to June 30, 1898	3, 635, 000
	3, 935, 00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Detailed information with reference to these subjects is given in a letter dated June 28, 1898, from Mr. Theo. C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

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This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1897, revenue to the amount of $14,042,298.63.

The nearest fort and light-houses are, respectively, Fort Mifflin and Upper Horseshoe range lights.

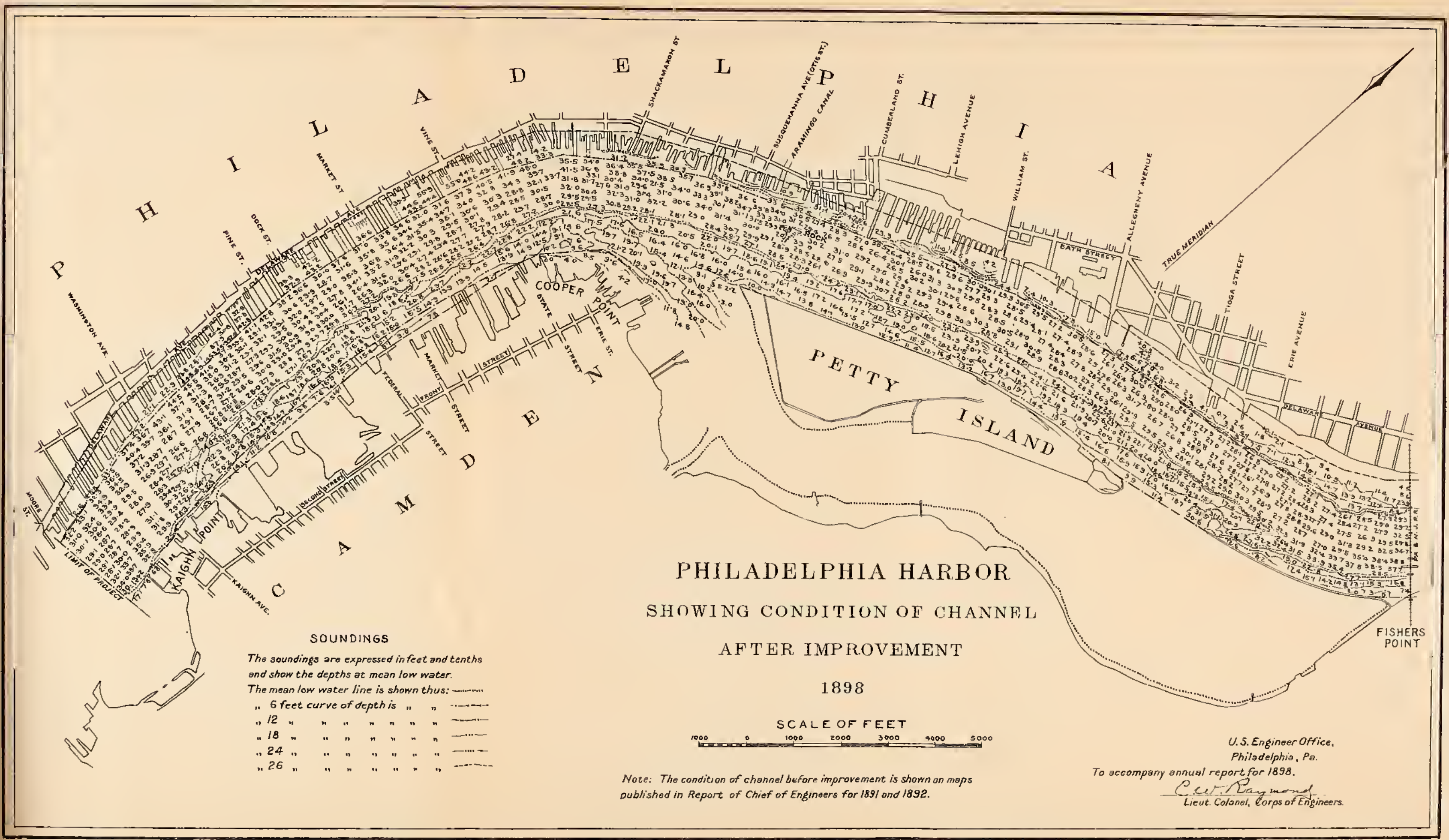
Money statement.

July 1, 1897, balance unexpended	$800,531.23
June 30, 1898, amount expended during fiscal year	798,127.17
July 1, 1898, balance unexpended	2,404.06
July 1, 1898, outstanding liabilities	300.00
July 1, 1898, balance available	2,104.06

Appropriations.

Act of—		Act of—	
August 11, 1888	$500,000	March 2, 1895	$850,000
September 19, 1890	200,000	June 11, 1896	600,000
March 3, 1891	300,000	June 4, 1897	694,000
August 5, 1892	41,000		
March 3, 1893	500,000	Total	3,935,000
August 18, 1894	250,000		

Total appropriations for part payment for land	300,000
Total appropriations under present project to June 30, 1898	3,635,000
	3,935,000



PHILADELPHIA HARBOR

SHOWING CONDITION OF CHANNEL AFTER IMPROVEMENT

1898

SOUNDINGS

The soundings are expressed in feet and tenths and show the depths at mean low water.

The mean low water line is shown thus:

- *6 feet curve of depth is*
- *12*
- *18*
- *24*
- *26*

SCALE OF FEET

1000 0 1000 2000 3000 4000 5000

Note: The condition of channel before improvement is shown on maps published in Report of Chief of Engineers for 1891 and 1892.

U.S. Engineer Office,
Philadelphia, Pa.
To accompany annual report for 1898.
C. W. Raymond
Lieut. Colonel, Corps of Engineers.

Expenditures.

Total to June 30, 1898		$3,932,595.94
Under present project for dredging and removal of pile and timber revetment	$3,276,880.36	
For depositing and spreading material on League Island	355,715.58	
For part payment of land	300,000.00	
		3,932,595.94

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE PROGRESS OF THE WORK OF RECONSTRUCTION OF THE DELAWARE RIVER WATER FRONT DURING THE FISCAL YEAR ENDING JUNE 30, 1898, WITH TWO INCLOSURES.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, Pa., June 28, 1898.

SIR: I beg to acknowledge the receipt of your communication under date of June 4, 1898, in which you ask to be furnished with a concise statement of what has been accomplished by the city of Philadelphia since June 30, 1897, in the improvement of the Delaware and Schuylkill rivers and the harbor of Philadelphia.

Under the head of the further improvement by the city, of the harbor of Philadelphia by means of the widening of Delaware avenue, I would report as follows:

Settlements for claims for damages by reason of the widening of the avenue which amounted to $700,000, have been satisfactory accomplished. Contracts have been entered into for the construction of a bulkhead and the alteration and extension of sewers. The details of these contracts and the description of the plans for the improvements will be found in full in the communication from Mr. George S. Webster, chief engineer and surveyor of the city of Philadelphia, which is inclosed herewith, marked Inclosure A. Portions of this work have been completed, and it is expected that the greater part of the bulkhead will be built and the avenue filled in during the coming autumn.

The list of licenses granted during the year by the board of port wardens for pier extension will be found in full in the accompanying letter from Mr. George F. Sproule, secretary of the board of port wardens, marked Inclosure B.

In addition to those therein named, it is expected that the Philadelphia and Reading Railroad in the near future will contruct a new pier north of Callowhill street of a width of 150 feet, giving, under existing regulations, 150 feet of dock room on either side.

It will be seen that the city has provided for the widening of Delaware avenue, between Vine and South streets, and the construction of several city piers in that area. Considerable remains to be done between these limits and also north of Vine street and south of South street. It is, however, to the private wharf owners that we must look for assistance in this respect, and there is no doubt that they will fully cooperate in order that the city may reap the full benefits of the work of the past eleven years.

Truly yours,

THEO. C. KNAUFF,
Secretary.

Lieut. Col. C. W. RAYMOND,
Corps of Engineers.

INCLOSURE A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, Pa., June 16, 1898.

DEAR SIR: Replying to your letter, requesting a statement of the progress of the work being carried on by the city in the widening of Delaware avenue, I report as follows:

The settlement of claims for the widening of the avenue, authorized by ordinance of October 6, 1896, and also from mandamus, amounting to nearly $700,000, has been made in a satisfactory manner. Plans were prepared for the construction of a concrete bulkhead on the easterly line of Delaware avenue, between Vine street and South street, and for the reconstruction and extension of sewers, made necessary by the changed conditions, contracts for which work were entered into as follows:

For the construction of the bulkhead, contractor, D. J. McNichol. Date of contract, September 18, 1897; limit of contract, $475,000. Work was authorized by ordinance of councils of April 13, 1896, and November 27, 1896. The latter ordinance authorized the acceptance of the sum of $650,000 for the construction of the bulkhead and building sewers, to be set aside by the city of Philadelphia, trustee, under the will of Stephen Girard.

The bulkhead consists of two types: One known as the general concrete section, provides for the placing of concrete blocks upon a pile foundation, and building concrete in place above low water. The other type known as the general timber section, which is to be used behind ferries and piers where the face of the bulkhead is not visible from the water side, consists of a timber platform on piles to an elevation slightly above low water, with sheet piling back of the platform and a wall of concrete for the bulkhead face built upon the outer end of the platform.

In order to obtain proper foundation for the general concrete section, the docks have been dredged out to gravel bottom and coarse gravel filled in to form a bank into which the piles for the support of the blocks have been driven. Most of the dredging and gravel filling has been done and piles driven.

A portion of the general timber section has been completed back of the ferries at the foot of Market street, and the avenue filled in, also back of the new ferry slips at the foot of Chestnut street. Blocks on a portion of the general concrete section have been set to the northward of Chestnut street and concrete is being put in place above low water. It is expected that a greater portion of the bulkhead will be built and the avenue filled in during the coming fall.

Contract No. 5.—Sewers on Deleware avenue between Vine and Market streets: Contractor, D. J. McNichol; date of contract, September 22, 1897; limit of contract, $20,000.

Contract No. 6.—Sewers on Delaware avenue between Market and Pine streets: Contractor, D. J. McNichol; date of contract, September 22, 1897; limit of contract, $25,000.

Work upon these contracts is progressing at points where the bulkhead is nearing completion.

The ordinance of April 13, 1896, authorized the widening and extension of four piers, at Dock, Chestnut, Arch and Race streets. Licenses were granted at various times for all four. By ordinance of November 23, 1897, the lease of the water at the foot of Dock street to the Pennsylvania Railroad Company, for a period of fifteen years, was effected, which carried with it an obligation to construct a pier, thus taking it out of the hands of the department of public works.

Contracts have been entered into as follows:

At the foot of Chestnut street, known as contract No. 8. Contractors, Armstrong & Printzenhoff; date of contract, November 11, 1897; limit of contract, $48,000; dimensions, 80 feet by 554 feet. The pier is nearing completion.

Extension of the pier at the foot of Arch street, contract No. 9. Contractors, Armstrong & Printzenhoff; date of contract, November 11, 1897; limit of contract, $43,000; dimensions, 80 feet by 531 feet. This work is nearing completion.

Extension of the pier at the foot of Race street. License was granted to the city of Philadelphia March 7, 1898. Plans for a pier 80 feet by 540 feet are prepared and ready for advertising. An appeal was made by adjoining owners from the decision of the board of port wardens, which is now pending. In case a favorable decision is obtained, the work of constructing the Race street pier will be at once begun.

Widening of Delaware avenue.

Date.	Description.	Amount.
Apr. 13, 1896	Building bulkhead, piers, paving, damages, etc. (loan)	$1,500,000
Nov. 27, 1896	Building bulkhead and laying appurtenant sewers, etc. (agreement and appropriation by the trustees of the Girard estate)	650,000
	Total	2,150,000

Yours truly,

G. S. Webster, *Chief Engineer.*

Theodore C. Knauff,
Secretary, Board of Harbor Commissioners.

Inclosure B.

Board of Port Wardens for the Port of Philadelphia, Pa.,
Philadelphia, June 10, 1898.

Dear Sir: In compliance with your request of the 8th instant, I send you here below the following list of licenses for pier extensions from June 30, 1897, to present date:

November 1, 1897, Pennsylvania Sugar Refining Company, to extend Pier 46, North wharves.

January 3, 1898, the Charles Hillman Ship and Engine Building Company, to extend Pier 65, North wharves.

January 20, 1898, the Philadelphia Grain Elevator Company, to extend pier at foot of Ann street.

March 7, 1898, city of Philadelphia, to construct a pier at foot of Race street.

April 4, 1898, Philadelphia and Reading Railway Company, to extend Pier 11, Port Richmond.

April 4, 1898, Baltimore and Philadelphia Steamboat Company, to extend Pier 7, North wharves.

April 4, 1898, Lehigh Valley Railroad Company, to extend two piers from in front of property above Arch street.

Very truly,

GEO. F. SPROULE, *Secretary.*

Mr. THEO. C. KNAUFF,
Secretary, Board of Harbor Commissioners.

H 3.

IMPROVEMENT OF SCHUYLKILL RIVER, PENNSYLVANIA.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 915.

Work under the contract dated November 6, 1896, with the Virginia Dredging Company, of Richmond, Va., for dredging a channel across the bar at the river's mouth, was completed April 21, 1897. Under this contract 62,983 cubic yards of material, scow measurement, were dredged.

During the past fiscal year, under an informal agreement entered into January 28, 1898, with John L. Grim, of Philadelphia, Pa., the pile dike at the mouth of the river has been raised by spiking two courses of 12-inch by 12-inch pine lumber to the top of the sheet piling along the front and end walls, a total distance of 1,734 feet, at a cost of $1,673.77, including inspection and superintendence.

In April and May, 1898, by purchase of materials and hire of labor in open market, the earthen dike at the same locality, which had become badly eroded, was repaired by restoring the bank to its original cross-section and revetting the outer slope with stone for a distance of 410 feet, at a cost of $656.80, including inspection and superintendence.

During the present season the filling of the dike will be raised to the level of the face wall by the deposit of coarse gravel and bowlders, with funds now available.

It is proposed to apply the sum of $10,371.18, which remains unallotted and available, to further improvement of the channel and repair of dikes at the mouth of the river, but it is considered desirable to defer the channel work until the effects of the currents under the new conditions have been determined.

During the past three years the city of Philadelphia has been engaged in improving the channel of this river under authorities of the Secretary of War dated September 3, 1895, and May 14, 1896. Up to the end of the past fiscal year about 263,370 cubic yards of material, as measured in the dump, had been removed from the channel and placed ashore.

Detailed information with reference to this subject is given in a letter dated June 28, 1898, from Mr. Theo. C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter is appended hereto.

These works have resulted in the formation of a channel with a minimum low-water depth of 24 feet, and a minimum width of about 125 feet through the bar at the mouth of the river; a channel with a depth of 22 feet at mean low water, and a width of 250 feet for a distance of about half a mile above the Penrose Ferry Bridge, and thence a similar channel to a point about one-fourth mile above Yankee Point, except at Yankee Point where the width is 300 feet. From a point opposite Fifty-eighth street, near Gibson Point, the channel has a width of 150 feet and a mean low-water depth of 20 feet for a distance of five-eighths of a mile.

This improvement can be completed in accordance with the adopted project with funds now available.

During the past fiscal year a survey of the river, made in accordance with the provisions of the river and harbor act of June 3, 1896, was completed from the mouth to Walnut Street Bridge, Philadelphia, a distance of 7.39 miles, and a project for further improvement submitted on March 5, 1898. The project provides for the formation by dredging of a channel with a depth of 26 feet at mean low water and a bottom width of 400 feet from outside the bar to Penrose Ferry Bridge, 1½ miles, and thence a bottom width of 390 to 400 feet to Gibson Point, about 3 miles; from Gibson Point to Walnut Street Bridge, about 2.9 miles, for a channel 22 feet deep at mean low water, and a bottom width varying from 320 to 400 feet. The total cost of the work was estimated at $3,153,000.

This work lies in the collection district of Philadelphia, at which, as a port of entry, there was collected during the year ending December 31, 1897, revenue to the amount of $14,042,298.63. The nearest fort and light-houses are, respectively, Fort Mifflin and Schuylkill River range lights.

Money statement.

July 1, 1897, balance unexpended	$14,473.76
June 30, 1898, amount expended during fiscal year	2,406.58
July 1, 1898, balance unexpended	12,067.18
July 1, 1898, amount covered by uncompleted contracts	696.00
July 1, 1898, balance available	11,371.18

Appropriations.

Act of—	
June 11, 1870	$15,000
March 3, 1871	10,000
June 10, 1872	40,000
March 3, 1873	40,000
June 23, 1874	20,000
March 3, 1875	20,000
August 14, 1876	20,000
June 18, 1878	30,000
March 3, 1879	25,000
June 14, 1880	40,000
March 3, 1881	40,000
August 2, 1882	$25,000
July 5, 1884	25,000
August 5, 1886	18,750
August 11, 1888	25,000
September 19, 1890	45,000
July 13, 1892	46,250
August 18, 1894	20,000
June 3, 1896	20,000
Total	525,000

Expenditures.

Total to June 30, 1898	$512,932.82

COMMERCIAL STATISTICS.

The following statement of the foreign and domestic commerce of the Schuylkill River for the years ending December 31, 1896 and 1897, has been compiled from returns made to this office by shippers, consignees, and carriers.

Freight movement.

Articles.	1896.		1897.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Asphalt	13,293	$191,295	19,912	$236,835
Chemicals	17,729	91,277	10,591	64,439
Clay	1,839	2,939	2,570	3,102
Coal	385,725	1,369,024	508,094	1,733,136
Hay	1,547	12,285	1,538	7,726
Ice	115,470	231,040	85,129	135,888
Iron ore	80,481	482,886	150,986	905,916
Lumber	60,624	361,781	2,533	19,205
Stone, building	23,883	196,878	19,661	248,279
Stone, paving	7,989	30,456	9,340	35,010
Sand	467,802	250,191	395,457	210,851
Wood, cord	27,084	100,613	15,322	75,257
Miscellaneous	77,184	5,224,567	50,242	4,744,488
Total	1,280,650	8,545,232	1,271,375	8,420,132
DEPARTING.				
Asphalt	567	28,350	600	27,643
Chemicals	2,868	60,071	1,651	46,388
Coal	197,284	760,462	86,171	273,184
Grain	62,450	786,000	517,290	7,547,000
Manure	88,682	132,534	49,250	49,250
Petroleum oil and products	1,542,898	20,489,040	1,603,671	22,812,870
Miscellaneous	39,086	3,495,919	57,813	5,429,137
Total	1,933,835	25,752,376	2,316,446	35,985,472

Vessel movement.

Class.	1896.		1897.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers	224	1,032	353	743
Sailing vessels	445	290	547	191
Canal boats and barges	4,489	2,341	4,567	2,252
Total	5,158	3,663	5,467	3,186

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE PROGRESS MADE BY THE CITY OF PHILADELPHIA IN THE WORK OF IMPROVING SCHUYLKILL RIVER, PENNSYLVANIA, DURING THE FISCAL YEAR ENDING JUNE 30, 1898, WITH ONE INCLOSURE.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, June 28, 1898.

SIR: I beg to acknowledge the receipt of your communication under date of June 4, 1898, in which you ask to be furnished with a concise statement of what has been accomplished by the city of Philadelphia since June 30, 1897, in the improvement of the Delaware and Schuylkill rivers and the harbor of Philadelphia.

In the matter of the improvement of the Schuylkill River by the city of Philadelphia, I would report that under contract No. 2, for the dredging of that river from Fifty-eighth street to its mouth, which was completed September 30, 1896, 89,370 cubic yards of material were removed (the amount not having been previously reported), which consisted of mud, sand, and coarse gravel, which material was all measured in the dump after settlement, and was all deposited beyond high-water mark behind river dikes.

At the time of the last report no work had been done under contract No. 3, for dredging between one-half mile above Penrose Ferry Bridge and Fifty-eighth street, but it has since been in progress during the latter part of 1897 and in the present year. Ninety-one thousand cubic yards of material, measured in the dump, have now been removed and placed above high-water mark. The work is nearing completion, the bulk of that remaining being the removal of high points.

Under contract No. 4, for work between Fifty-eighth street and Walnut street, 3,000 cubic yards of material were reported removed at the time of the last report. I would report at the present time the removal of 83,000 cubic yards, which has been placed beyond high-water mark.

There is some rock in this contract south of the Baltimore and Philadelphia Railroad Bridge, for the removal of which preparations are now being made. Other than this, the dredging of material has been about finished, and the contract will in all probability be completed this season.

The sum of $40,000 has been set aside by the city ordinance dated January 7, 1898, for continuing the improvement of the Schuylkill River. Proposals have been requested for this work, and it is expected that the bids will be opened to-day, June 28, 1898. By means of this appropriation it is intended to continue dredging between the terminus of contract No. 3, above Yankee Point, and Fifty-eighth street. Whatever balance there may be will be expended above the terminus of contract No. 4, which is south of the Baltimore and Philadelphia Railroad Bridge.

For the statement of the details of these contracts and of the work done under them I am indebted to Mr. George S. Webster, chief engineer and surveyor of the city of Philadelphia, a copy of whose communication, marked A, is herewith inclosed.

Yours, truly,

THEO. C. KNAUFF, *Secretary.*

Lieut. Col. C. W. RAYMOND,
Corps of Engineers.

INCLOSURE A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, June 16, 1898.

DEAR SIR: Replying to your letter requesting information upon the improvement of the channel of the Schuylkill River, being carried on by the city of Philadelphia, I report as follows:

Contract No. 2.—Dredging in the Schuylkill River between Fifty-eighth street and its mouth. The work consisted in dredging a channel averaging 250 feet in width, 22 feet deep, between Penrose Ferry Bridge and a point about 3,000 feet above the bridge, as far as the money permitted. Work authorized December 28, 1894. Contractor, Frank C. Somers, Camden, N. J. Date of contract, October 16, 1895. Amount of contract, $40,000. Work completed September 30, 1896.

There were 89,370 cubic yards of material removed, consisting of mud, sand and coarse gravel, which were deposited beyond high-water mark, behind river dikes, and measured in the dump after settlement.

Contract No. 3.—Dredging in the Schuylkill River between a point about half a mile above Penrose Ferry Bridge and Fifty-eighth street. Authorized May 26, 1896. Contractor, The Philadelphia Public Works Company. Date of contract, September 7, 1896. Limit of contract, $40,000. Channel width, 250 feet; depth, 22 feet.

Work has been in progress during the latter part of the year 1897, and during 1898 up to the present time.

There have been removed, and placed beyond high-water mark, 91,000 cubic yards of material, measured in the dump.

Work upon this contract is nearing completion, the bulk of the remaining work being the removal of high points.

Contract No. 4.—Schuylkill River, from Fifty-eighth street toward Walnut street, as far as the appropriation will reach. Authorized December 28, 1895. Contractor, The Philadelphia Public Works Company. Date of contract, September 7, 1896. Limit of contract, $45,000.

Channel width, 150 feet; depth, 20 feet, to a point 700 feet above Harrison's wharf, and 18 feet between this point and Walnut street.

There have been removed and placed beyond high-water mark 83,000 cubic yards.

There is some rock in this contract south of the Baltimore and Philadelphia Railroad Bridge, preparations for the removal of which are now being made. Dredging material other than rock has been about completed, and it is probable the contract will be completed this season.

By ordinance of January 7, 1898, the sum of $40,000 was set aside for continuing the improvement of the Schuylkill River. Proposals are requested for this work, to be opened June 28, 1898.

It is intended to continue the dredging between the terminus of contract No. 3, above Yankee Point, and Fifty-eighth street, any balance to be expended above the terminus of the present contract No. 4, which is south of the Baltimore and Philadelphia Railroad Bridge.

Table of appropriations.

Date.	Description.	Amount.
Dec. 28, 1894	Allotment for removing impediments to navigation	$40,000
Dec. 28, 1895	Improving Schuylkill, between 58th and Walnut streets	50,000
May 26, 1896	Work between point above Penrose Ferry Bridge and 58th street	40,000
Jan. 7, 1898	To continue the dredging	40,000
	Total	170,000

Yours, truly,

GEO. S. WEBSTER, *Chief Engineer.*

Mr. THEODORE C. KNAUFF,
Secretary Board of Harbor Commissioners.

H 4.

IMPROVEMENT OF ICE HARBOR AT MARCUS HOOK, PENNSYLVANIA.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 918.

Since 1889 expenditures have been confined to maintenance and repairs. During the past fiscal year two landing piers have been repaired and a new mooring post placed at a cost of $700, including inspection and superintendence. The funds now available are considered sufficient for all probable necessities.

This work is located in the collection district of Philadelphia. This is the nearest port of entry; the collections during the year ending December 31, 1897, amounting to $14,042,298.63. The nearest fort and light-house are, respectively, Fort Mifflin and Cherry Island, *rear.*

Money statement.

July 1, 1897, balance unexpended	$2,415.72
June 30, 1898, amount expended during fiscal year	700.00
July 1, 1898, balance unexpended	1,715.72

Appropriations.

Act of—		Act of—	
June 23, 1866	$5,000	August 5, 1886	$15,000
March 2, 1867	94,000	August 11, 1888	15,000
January 14, 1880	35,000	September 19, 1890	5,000
March 3, 1881	30,000		
August 2, 1882	15,000	Total	214,000

Expenditures.

Total to June 30, 1898	$212,284.28

H 5.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES, DELAWARE.

An account of this work is contained in the Annual Report of the Chief of Engineers for 1896, page 920.

The river and harbor act of June 3, 1896, appropriated $7,660 for the maintenance and repair of this pier.

On September 11, 1896, a project for the application of the funds appropriated was submitted to the Department and approved September 18, 1896.

Under date of September 18, 1897, contract was entered into with William H. Virden, of Lewes, Del., for repairs to the pier in accordance with the adopted project approved September 18, 1896.

During the past fiscal year the contract above referred to was completed, the following repairs having been made, at a cost of $6,722.39, including inspection and superintendence: Forty-one fender piles were driven (40 on head of pier and 1 on the bridge); 42 fender piles shod with iron strips; 449 feet of wale on west side replaced by creosoted timber; 535 feet of wale on the east side, 720 feet of curbing, and the decking at the head of the pier replaced by new timber; a walk 3 feet wide laid on either side of the head of the pier and between the tracks for entire length of pier; the foot walk on the bridge repaired, and three supporting columns recovered and put back in place.

It is proposed to hold the sum of $937.61 which remains available for maintenance and repairs as needed.

The funds now available are considered sufficient for present needs.

This pier is in the collection district of Delaware, the nearest port of entry being Wilmington, where the amount of revenue collected during the year ending December, 31, 1897, was $14,775. The nearest fort and light-house are, respectively, Fort Delaware and Delaware Breakwater Light.

Money statement.

July 1, 1897, balance unexpended	$7,660.00
June 30, 1898, amount expended during fiscal year	6,722.39
July 1, 1898, balance unexpended	937.61

Appropriations.

Act of—		Act of—	
July 15, 1870	$225,000	June 14, 1880	$10,000
June 23, 1874	10,000	March 3, 1881	10,000
March 3, 1875	25,000	August 2, 1882	13,000
March 3, 1875	15,000	April 4, 1890	10,000
August 14, 1876	30,000	June 3, 1896	7,660
June 18, 1878	20,000		
March 3, 1879	10,500	Total	386,160

Expenditures.

Total to June 30, 1898	$385,222.39

H 6.

IMPROVEMENT OF DELAWARE BREAKWATER, DELAWARE.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 922.

Work under the contract dated November 16, 1894, with George Willett Andrews, of Biddeford, Me., for depositing stone in cavities and building a part of the superstructure of the breakwater was completed on October 15, 1896. Under this contract $16,149\frac{1895}{2240}$ tons of stone were placed in the work, of which $7,532\frac{510}{2240}$ tons were deposited during the fiscal year ending June 30, 1897.

Under date of September 15, 1896, contract was entered into with John F. Donovan, of New York, N. Y., for continuing the work of closing the gap in the breakwater by furnishing and depositing stone to the extent of the funds available, the work to be commenced on or before April 1, 1897, and completed on or before June 30, 1898. Work under this contract was commenced on April 1, 1897, and completed June 30, 1898, at a cost of $86,726.42, including superintendence and inspection. Under this contract 36,472.1 tons of stone were placed in the work, of which 26,926.1 tons were deposited during the past fiscal year, completing the improvement. The total quantity deposited under the present project is about 207,102 tons.

By the work done the gap, 1,390 feet long, formerly existing between the ice breaker and the main breakwater has been closed by a structure rising 14 feet above low water, 40 feet wide at low water, and 20 feet wide on top, thus forming a continuous wall from the lower end of the old breakwater to the upper end of the ice breaker.

The project is completed and no further appropriation is required. It is probable that occasional small appropriations will be required in the future to repair damages caused by violent storms.

From a survey of the Breakwater Harbor made in June, 1898, it appears that slight shoaling has continued over the middle bar, while occasional scour has taken place between the bar and the Delaware shore.

During the present season, with funds now available, it is proposed to make a thorough examination and submit a final report upon this work.

The commercial statistics of the harbor at and in the vicinity of this breakwater are given in connection with the report on the harbor of refuge, Delaware Bay, Delaware.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the revenue collected during the year ending December 31, 1897, was $14,775. Fort Delaware is the nearest fort and the Breakwater Light the nearest light-house.

Money statement.

July 1, 1897, balance unexpended	$86,361.56
June 30, 1898, amount expended during fiscal year	76,651.45
July 1, 1898, balance unexpended	9,710.11
July 1, 1898, outstanding liabilities	8,486.53
July 1, 1898, balance available	1,223,58

Appropriations.

Act of—		Act of—	
May 7, 1822	$22,700.00	June 23, 1866	$107,910.00
May 23, 1828	250,000.00	March 2, 1867	109,493.70
April 23, 1830	162,000.00	August 2, 1882	125,000.00
March 2, 1831	208,000.00	July 5, 1884	75,000.00
July 3, 1832	270,000.00	August 5, 1886	56,250.00
March 3, 1833	270,000.00	August 11, 1888	100,000.00
June 28, 1834	270,000.00	September 19, 1890	80,000.00
March 3, 1835	100,000.00	July 13, 1892	50,000.00
July 2, 1836	100,000.00	August 18, 1894	50,000.00
July 4, 1836 (survey)	1,000.00	June 3, 1896	80,000.00
March 3, 1837	141,000.00		
July 7, 1838	150,000.00	Total	2,808,353.70
August 30, 1852	30,000.00		

Total amount appropriated under present project to June 30, 1898	$616,250.00

Expenditures.

Total to June 30, 1898	$2,798,643.59
Total under present project to June 30, 1898	606,539.89

H 7.

CONSTRUCTION OF HARBOR OF REFUGE, DELAWARE BAY, DELAWARE.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1897, page 1216.

During the past fiscal year, under a contract with Messrs. Hughes Bros. & Bangs dated February 5, 1897, 289,709 tons of stone were deposited in the work, the total amount deposited to June 30, 1898, being 298,744 tons.

The contract above referred to provides for the complete execution of the work, to be paid for as appropriations may from time to time be made by law. It required the placing of 125,000 tons of stone during the year ending December 31, 1897, as estimated by the engineer officer in charge, under the terms of the contract; and for the continuance of the work as rapidly as may be required by the engineer officer in charge, to the extent of placing 280,000 tons during any one calendar year, provided sufficient funds are available for payment therefor. The work is required to be commenced on or before May 1, 1897, and to be completed on or before December 31, 1901, unless prevented by lack of funds.

On December 31, 1897, 131,106 tons of stone had been deposited in accordance with the terms of the contract.

The condition of the work June 30, 1898, was as follows:

Beginning at the stake light, which was erected May 4, 1897, to mark the initial point of the upper part of the work, and running thence S. SE. $\frac{7}{8}$ E., the substructure has been brought to a width of about 41 feet at mean low water for a distance of 2,800 feet, thence for a further distance of 1,900 feet it is partly completed to a height of about 10 feet below mean low water.

This work is situated in the collection district of Delaware. Wilmington is the nearest port of entry, at which the revenue collected during the year ending December 31, 1897, was $14,775. Fort Delaware is the nearest fort, and the Breakwater Light the nearest light-house.

Money statement.

July 1, 1897, balance unexpended		$396, 939. 98
Amount appropriated by sundry civil act approved July 1, 1898		800, 000. 00
		1, 196, 939. 98
June 30, 1898, amount expended during fiscal year		279, 151. 73
July 1, 1898, balance unexpended		917, 788. 25
July 1, 1898, outstanding liabilities	$85, 845. 55	
July 1, 1898, amount covered by uncompleted contracts	831, 942. 70	
		917, 788. 25
Amount (estimated) required for completion of existing project		1, 150, 666. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900		587, 500. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

Act of—	
June 3, 1896	$5, 000
June 4, 1897	394, 334
July 1, 1898	800, 000
Total	1, 199, 334

Expenditures.

Total to June 30, 1898	$281, 545. 75

CONTRACT IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

With Hughes Bros. & Bangs, of Syracuse, N. Y., dated February 5 and approved February 20, 1897, for complete execution of the work of constructing a stone breakwater, to be paid for as appropriations may be made from time to time by law. To be commenced on or before May 1, 1897, and completed on or before December 31, 1901, unless prevented by lack of funds.

COMMERCIAL STATISTICS.

During the year ending December 31, 1897, the following vessels called at Delaware Breakwater for the reasons given:

	Steamers.	Ships.	Barks.	Brigs.	Schooners.	Barges.	Total.
For orders	128	23	47	11	31	....	240
For harbors	78	13	22	9	1, 251	241	1, 614
In distress	1	....	....	1	2	....	4
Quarantined	1	....	....	....	....	....	1
Total	208	36	69	21	1, 284	241	1, 859

H 8.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 925.

The original project, adopted in 1881, provided for the improvement of the main river and the Mount Holly Branch, and contemplated no improvement in the Lumberton Branch. The river and harbor act of June 3, 1896, appropriated $2,000 for continuing this improvement, this sum to be expended in the improvement of the Lumberton Branch.

The Lumberton Branch was surveyed as far as Lumberton, N. J., in 1897, and a project for its improvement approved July 3, 1897.

The project provided for the formation, by dredging, of a channel 30 feet wide at mean low water through the shoals at Patterson's Landing and below and above Paxson's Landing as far as available funds would permit.

Under date of September 11, 1897, contract was entered into with Frank C. Somers, of Camden, N. J., for the dredging required by the project.

Work under this contract was commenced October 19, 1897, and completed November 5, 1897, 5,026 cubic yards having been dredged, at a cost of $1,767.59, including inspection and superintendence. The cost of the survey of the Lumberton Branch, made during the fiscal year ending June 30, 1987, was $232.41.

By the work done a channel 30 feet wide and 6 to 7 feet deep at mean low water was formed through the shoals at Patterson's Landing and below Paxson's Landing, and partly formed through the shoal above Paxson's Landing, the total lengths of channel aggregating 1,675 feet, thereby completing the work provided for in the project.

This work is situated in the collection district of Burlington, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1897. The nearest fort is Fort Mifflin, and the Horseshoe lights are the nearest light-houses.

Money statement.

July 1, 1897, balance unexpended	$2,167.29
June 30, 1898, amount expended during fiscal year	1,767.59
July 1, 1898, balance unexpended	*399.70

APPROPRIATIONS.

Mount Holly Branch.

Act of—

March 3, 1881	$10,000.00
August 2, 1882	10,000.00
September 19, 1890	10,000.00
July 13, 1892	5,000.00
August 18, 1894	3,000.00
	38,000.00

Lumberton Branch.

Act of June 3, 1896	$2,000.00
Total	40,000.00

EXPENDITURES.

Total to June 30, 1898	$39,500.21
Carried to the surplus fund in July, 1890	100.09
Redeposited to credit of appropriation, December 21, 1895	399.70
	40,000.00

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1896 and 1897.

Kind of vessel.	Arrivals.				Departures.			
	1896.		1897.		1896.		1897.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	398	79,600	308	65,400	398	79,600	308	65,400
Sailing vessels	107	6,420	150	7,250	107	6,420	150	7,250
Barges and canal boats	3,447	629,500	2,437	609,250	3,447	629,500	2,437	609,250
Total	3,952	715,520	2,895	681,900	3,952	715,520	2,895	681,900

Freight statement.

Articles.	1896.		1897.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Chemicals	6,300	$40,300	6,500	$43,200
Coal	16,400	50,600	34,000	97,000
Iron, pig	4,000	45,000	4,400	48,400
Lime	4,000	8,000	10,000	20,000
Lumber	1,000	21,000	....	....
Manure	37,500	50,000	75,000	112,500
General merchandise	11,800	397,000	6,500	267,450
Total	81,000	611,900	136,400	588,550
DEPARTING.				
Bricks	10,000	22,000	....	....
Canned goods	500	25,000	....	....
Sand, molding	66,700	93,425	144,094	216,000
Sand and gravel	149,725	59,890	62,306	61,300
Produce	3,600	140,000	6,500	325,000
General merchandise	1,000	23,500	5,700	263,500
Total	231,525	363,815	218,600	865,800

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*Balance remaining from appropriation of August 18, 1894, not available for expenditure under present project.

H 9.

IMPROVEMENT OF ALLOWAY CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 928.

Under date of March 16, 1897, contract was entered into with John L. Grim, of Philadelphia, Pa., for the construction of about 400 linear feet of pile dike and the dredging of about 7,500 cubic yards of material, scow measurement, from the channel of the creek above Upper Hancock Bridge.

During the past fiscal year work was in progress under the above mentioned contract which was completed in September, 1897. Under this contract 404 linear feet of dike were constructed during the fiscal year ending June 30, 1897, and 4,269 cubic yards of material were removed during the past fiscal year, at a total cost, including inspection, and superintendence, of $2,640.50. About three-fifths of the projected work has been accomplished.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1897. The nearest fort is Fort Delaware, and the Reedy Island Light is the nearest light-house.

Money statement.

July 1, 1897, balance unexpended	$2,766.08
June 30, 1898, amount expended during fiscal year	2,413.53
July 1, 1898, balance unexpended	352.55
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

Act of—

September 19, 1890	$6,000
July 13, 1892	3,000
August 18, 1894	3,000
June 3, 1896	3,000
Total	15,000

Expenditures.

Total to June 30, 1898	$14,647.45

COMMERCIAL STATISTICS.

Arrival and departure of vessels for the years ending December 31, 1896 and 1897.

Kind of vessel.	Arrivals.				Departures.			
	1896.		1897.		1896.		1897.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	65	6,850	62	6,500	65	6,850	62	6,500
Sailing vessels	35	3,500	30	3,000	35	3,500	30	3,000
Barges and canal boats	62	9,300	57	8,700	62	9,300	57	9,300
Total	162	19,650	149	18,200	162	19,650	149	18,800

Freight statement.

Articles.	1896.		1897.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Coal	9,000	$23,000	9,000	$20,000
Glass sand	1,700	1,850	1,700	1,800
Lumber	3,500	37,000	3,000	30,000
Oyster shells	2,500	5,000	2,500	5,000
Soda ash	450	8,500	450	8,000
Tin plate	1,300	110,000	1,300	100,000
Miscellaneous	9,000	197,000	9,000	192,000
Total	27,450	382,350	26,950	356,800
DEPARTING.				
Canned goods	8,000	379,000	8,000	380,000
Glass	2,000	110,000	2,000	100,000
Grain and farm products	3,500	58,000	3,500	50,000
Ship timber	125	3,000	125	3,000
Miscellaneous	1,000	3,500	1,000	3,000
Total	14,625	553,500	14,625	536,000

H 10.

IMPROVEMENT OF COOPER CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 931.

The river and harbor act of June 3, 1896, appropriated $37,000 for completing this improvement, of which amount $2,500, or so much thereof as might be necessary, was to be expended in rebuilding the dike on Government reservation in the Delaware River at Woodbury Creek.

Under date of October 7, 1896, contract was entered into with Frank C. Somers, of Camden, N. J., for rebuilding the dike on the Government reservation at Woodbury Creek. Work under this contract was completed on November 13, 1896, the total amount expended being $2,500.

Under date of October 19, 1896, contract was entered into with A. M. Clegg, of Washington, D. C., for dredging about 162,000 cubic yards of material from the channel of the creek in completion of the project. Work under this contract was commenced on April 12, 1897.

During the fiscal year ending June 30, 1897, 55 cubic yards of material, scow measurement, were dredged from the channel.

During the past fiscal year operations were in progress under the above-mentioned contract, 47,735 cubic yards, scow measurement, having been dredged from the channel, making a total to date of 47,790 cubic yards.

On October 23, 1897, the contractor withdrew his plant from the work without notice. The time for the completion of the contract expired December 31, 1897, and it was recommended that it be annulled and that the work be readvertised.

This recommendation was approved by the Chief of Engineers, United States Army, under date of January 8, 1898. Under date of January 12, 1898, the Secretary of War directed that the contract be not annulled until the contractor was heard from in reply to the notice of annulment sent him January 10, 1898.

Under date of May 9, 1898, instructions were received from the

Department that, at the request of the Assistant Secretary of War, the time for completion of the contract had been extended to September 1, 1898.

Under date of June 25, 1898, the Comptroller of the Treasury gave a decision in reference to this case to the effect that this contract expired by its own limitation on December 31, 1897, and it was not within the power of any officer to revive the same as an executory contract, and that as Mr. Clegg has defaulted under the contract of October 19, 1896, no payment whatever should be made to him for any work subsequently done on Cooper Creek until it can be ascertained what amount of damage the United States has sustained on account of his default. The contractor was notified accordingly.

Dredging operations were still in progress June 30, 1898.

This work is located in the collection district of Philadelphia. This is the nearest port of entry. The collections during the year ending December 31, 1897, amounted to $14,042,298.63. The nearest fort and light-house are, respectively, Fort Mifflin and Upper Horse Shoe range lights.

Money statement.

July 1, 1897, balance unexpended	$34,110.06
June 30, 1898, amount expended during fiscal year	2,991.58
July 1, 1898, balance unexpended	31,118.48
July 1, 1898, outstanding liabilities	4,204.12
July 1, 1898, balance available	26,914.36

Appropriations.

Act of June 3, 1896	$37,000

Expenditures.

Rebuilding dike on Government reservation in Delaware River at Woodbury Creek	$2,500.00
Improvement of Cooper Creek, New Jersey	3,381.52
Total to June 30, 1898	5,881.52

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1896 and 1897.

Kind of vessel.	Arrivals.				Departures.			
	1896.		1897.		1896.		1897.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steamers	2	600	16	4,800	2	600	16	4,800
Sailing vessels	60	6,000	99	79,200	60	6,000	99	79,200
Barges and canal boats	626	125,200	670	140,000	626	125,200	670	140,000
Total	688	131,800	785	224,000	688	131,800	785	224,000

Freight statement.

Articles.	1896.		1897.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Bricks	800	$3, 500	600	$2, 800
Chemicals	8, 406	93, 225	11, 239	163, 151
Coal	45, 167	124, 848	41, 553	102, 704
Fertilizer	5, 241	35, 900	5, 614	73, 000
Hay	1, 269	8, 583	240	1, 950
Iron, pig	38, 346	426, 306	40, 840	428, 820
Lumber	1, 545	13, 450	1, 000	11, 000
Manure	25, 000	37, 500	20, 000	35, 000
Oil	431	34, 471	7, 188	96, 071
Sand	7, 402	7, 344	10, 000	11, 500
Miscellaneous	3, 494	663, 444	10, 507	254, 425
Total	137, 101	1, 448, 571	148, 781	1, 180, 421
DEPARTING.				
Chemicals	200	2, 800	70	1, 400
Fertilizer	7, 000	140, 000	8, 000	160, 000
Iron, manufactured	23, 615	472, 300	24, 370	422, 820
Produce	32, 000	640, 000	30, 000	600, 000
Miscellaneous	1, 680	212, 338	1, 216	103, 504
Total	64, 495	1, 467, 438	63, 656	1, 287, 724

H 11.

IMPROVEMENT OF GOSHEN CREEK, NEW JERSEY.

An account of this improvement is contained in the Annual Report of the Chief of Engineers for 1896, page 933.

During 1893, 15,770 cubic yards of material, scow measurement, were dredged from the channel below Goshen Landing, thus practically completing the improvement to the mouth of the creek. Work was then discontinued until 1897 for want of sufficient funds.

Under date of March 15, 1897, contract was entered into with Mr. Frank C. Somers, of Camden, N. J., for constructing about 600 feet of pile dike at the entrance of the creek and dredging about 8,000 cubic yards, scow measurement, from the channel. Work under this contract was commenced on May 18, 1897.

During the fiscal year ending June 30, 1897, the pile dike was constructed to its projected length of 600 feet, and 8,002 cubic yards of material, dipper measurement, were removed from the channel in the vicinity of the dike, completing the work under this contract on June 30, 1897.

The original cost of the project made in 1891 was estimated at $12,000, this estimate being based on a single appropriation of $12,000, by which the improvement could be made in a single season. On account of the small appropriations the work has been carried through an interval of several years, and it has not been executed with sufficient rapidity to prevent injurious changes which will considerably increase the cost of the improvement.

During the past fiscal year an examination of the dike and dredged channel was made and a new estimate, based on a careful survey of present conditions, was made of the cost of completing the work in accordance with the project. In order to maintain the dredged channel, it will be necessary to extend the dike somewhat farther toward the shore and to dredge through the bar at the mouth of the creek.

The cost of this work, in addition to funds now available, is estimated at $8,000, which will increase the cost of the project from $12,000, as originally estimated, to $17,000.

This work is situated in the collection district of Bridgeton, N. J., which is the nearest port of entry, at which no revenue was collected during the year ending December 31, 1897. The nearest fort is Fort Delaware, and the Maurice River Light is the nearest light-house.

Money statement.

July 1, 1897, balance unexpended	$5,837.40
June 30, 1898, amount expended during fiscal year	4,282.76
July 1, 1898, balance unexpended	1,554.64
Amount (estimated) required for completion of existing project	8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	8,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

Act of—	
July 13, 1892	$3,000
August 18, 1894	3,000
June 3, 1896	3,000
Total	9,000

Expenditures.

Total to June 30, 1898	$7,445.36

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the years ending December 31, 1896 and 1897.

Kind of vessel.	Arrivals.				Departures.			
	1896.		1897.		1896.		1897.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Sailing vessels	100	2,000	100	2,000	100	2,000	100	2,000

Freight statement.

Articles.	1896.		1897.	
	Tons.	Value.	Tons.	Value.
ARRIVING.				
Brick	2,000	$8,000	2,500	$10,000
Coal	1,000	5,000	1,500	7,500
Fertilizer	1,000	32,000	1,500	48,000
Grain	3,000	54,000	5,000	90,000
Lumber	2,000	19,000	3,000	30,000
General merchandise	1,500	75,000	2,000	100,000
Total	10,500	193,000	15,500	285,500
DEPARTING.				
Fertilizer	500	2,000	1,000	4,000
Hay	1,500	8,000	3,000	16,000
Oysters and clams	1,800	30,800	2,000	37,000
Potatoes	300	1,125	400	1,600
Sand	4,000	4,000	4,000	4,000
Wood	1,700	10,000	1,700	10,000
General merchandise	1,800	27,000	2,000	40,000
Total	11,600	82,925	14,100	112,600

H 12.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

During the past fiscal year no wrecks have been removed under the authority of the act of Congress approved June 14, 1880.

In September, 1895, the three-masted schooner *Lottie K. Friend*, with a cargo of coal, was sunk in Delaware Bay in collision with another vessel, about 1¼ miles west from Ship John Light. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of February 18, 1897, a contract was entered into with Thomas Poynter and Elijah D. Register, of Lewes, Del., for the removal of the wreck for the sum of $1,100, the work to be completed on or before April 25, 1897. At the close of the fiscal year ending June 30, 1897, the removal of the wreck had not been completed.

During the past fiscal year no work has been done toward the removal of the wreck under the above contract, and on June 16, 1898, it was recommended that the contract be annulled and the remaining wreckage be removed by dredging at some time when dredging operations were in progress in the neighborhood. This recommendation was approved on June 18, 1898.

In May, 1897, the ship *Francis* with a cargo of wines, canned salmon, and miscellaneous freight, caught fire off the New Jersey coast and was beached near Tucker Island Light, off Little Egg Harbor Inlet. The wreck being a dangerous obstruction to navigation, its removal was recommended. In December, 1897, a second and more detailed examination of the wreck was made, and it was found that it had settled in the sand so much as to make its removal unnecessary. In May, 1898, another examination of the wreck was made, and it being found to be no longer an obstruction to navigation, it was recommended that no further action be taken toward its removal, which recommendation was approved by the Department on May 28, 1898.

In January, 1898, the wreck of the pleasure craft *David W. Sellers*, which, in September, 1897, was carried over the dam of the Fairmount waterworks, in the Schuylkill River, Pennsylvania, became lodged in the channel of the river opposite the works of the Atlantic Refining Company, Philadelphia. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Before contract could be entered into for the removal of the wreck it was removed by private parties and placed where it was no longer an obstruction to navigation. It was recommended that no further action be taken for the removal of the wreck, which recommendation was approved by the Department on March 8, 1898. No expenditures were incurred on account of this wreck.

In June, 1895, the schooner *Anna Maria*, engaged in the oyster trade of Maurice River, New Jersey, sunk without cargo in that river about 1 mile above the mouth. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Proposals for its removal will be opened July 18, 1898.

The amount expended during the past fiscal year upon removal of wrecks is $153.53.

H 13.

SURVEY OF DELAWARE RIVER WITH A VIEW TO OBTAINING A CHANNEL 600 FEET WIDE AND 30 FEET DEEP FROM A POINT AT OR NEAR THE CITY OF PHILADELPHIA TO THE DEEP WATER OF DELAWARE BAY.

[Printed in House Doc. No. 219, Fifty-fifth Congress, second session.]

Office of the Chief of Engineers,
United States Army,
Washington, D. C., January 10, 1898.

Sir: I have the honor to submit the accompanying report of January 5, 1898, with map,* by Maj. C. W. Raymond, Corps of Engineers, of the results of a survey of Delaware River with a view to obtaining a channel 600 feet wide and 30 feet deep from a point at or near the city of Philadelphia to deep water of Delaware Bay, made to comply with the requirements of the river and harbor act of June 3, 1896.

The systematic improvement of this river with a view to obtaining a channel 600 feet wide and 26 feet deep at mean low water from Philadelphia to the bay is now in progress, and that portion of the river along the front of the city of Philadelphia has been improved to the extent of securing a channel having a least depth of 26 feet and a least width of 1,000 feet, while from the foot of Petty Island to a point opposite Christian street, Philadelphia, there is practically a depth of 30 feet at mean low water over a width of 600 feet.

The project now presented contemplates improving the river from a point opposite Christian street, Philadelphia, to the bay, along the axis of the main ship channel, to obtain a channel 600 feet wide and 30 feet deep at mean low water, by dredging and by removal of rock near Petty Island and at Schooner Ledge, estimated to cost, including contingencies, $5,935,000, exclusive of work now under contract and work authorized by the Secretary of War to be done by the city of Philadelphia as indicated.

Major Raymond states that under the most favorable conditions the execution of the project will require about six years; that to conduct the work successfully and economically it should be done under a continuous contract, and that the above estimate of cost is based upon the assumption that the improvement is to be executed by this method.

The question of maintenance of the proposed channel is fully discussed by Major Raymond in his report, and his views on this point are summarized as follows:

> I am of the opinion that the practicability of maintaining a channel 30 feet deep at mean low water at reasonable cost from the mouth of the river to Pea Patch Island can only be determined by trial, and that such a channel could undoubtedly be maintained at reasonable cost above Pea Patch Island, except at Cherry Island Flats, where there is reasonable ground to hope for success.

In his letter transmitting this report to this office Major Raymond states that in his opinion the proposed improvement is worthy of execution and justified by the needs of the commerce involved.

Very respectfully, your obedient servant,

John M. Wilson,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. Alger,
Secretary of War.

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*Not reprinted. Printed in House Doc. No. 219, Fifty-fifth Congress, second session.

REPORT OF MAJ. C. W. RAYMOND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., January 5, 1898.

GENERAL: I have the honor to submit the following report upon a survey of the "Delaware River, with a view to obtaining a channel 600 feet wide and 30 feet deep from a point at or near the city of Philadelphia to the deep water of Delaware Bay," provided for by the river and harbor act of June 3, 1896.

Under the authority of the Secretary of War, contained in Department letter dated September 9, 1896, this survey was postponed until the removal of certain legal restrictions upon the expenditure of funds appropriated for the improvement of the river. Authority to continue the survey was granted by Department letter dated June 1, 1897.

The systematic improvement of the Delaware River with a view to obtaining a channel 600 feet wide and 26 feet deep at mean low water from Philadelphia to the bay has been in progress since 1885, and detailed surveys of different parts of the channel have been made in connection therewith. For the purposes of the present investigation it has therefore been necessary to make only such additional surveys as are required to determine the cost of the proposed increase in channel depth. These additional surveys have been made under my direction by Mr. R. G. Pearson, United States surveyor.

The improvement of the harbor of Philadelphia, which consists of the part of the Delaware River extending along the city front, was practically completed on January 1, 1898, and the channel has now a depth of at least 26 feet at mean low water over a least width of 1,000 feet. From the foot of Petty Island to a point opposite Christian street, Philadelphia, the channel is now practically 30 feet deep at mean low water over a width of 600 feet. For a long time to come it will be neither necessary nor desirable to increase the depth of the upper part of the harbor to 30 feet; but a rock opposite the foot of Petty Island, which was not discovered by the preliminary borings, but which was developed by the dredging, should be removed from the channel. Accordingly the "point at or near the city of Philadelphia" to which the act requires the survey to extend has been assumed as opposite Christian street, Philadelphia.

The distance from this point to deep water in Delaware Bay, measured along the axis of the main ship channel, is about 56 miles. The cost of creating a channel of the dimensions proposed depends upon the quantity and character of the material to be removed and the places and methods available for its disposal. The different parts of the channel vary greatly in all these respects, and it has therefore been found convenient to divide the river into a number of sections and investigate each section by itself.

The detailed hydrographic surveys of the Engineer Department, made in 1889, 1890, 1891, 1892, 1893, 1895, 1896, and 1897, have been employed in the preparation of this project. With the exception of the shore lines, which have been taken from charts Nos. 125 and 126 of the United States Coast and Geodetic Survey, the map submitted herewith has been prepared from the surveys above mentioned, the originals of which are on file in this office. It shows the hydrography of the river in sufficient detail for the purposes of this report. All computations of quantities to be excavated have been made from the original detailed maps. The sections into which the river has been divided for convenient investigation and computation are indicated on the map and numbered in succession from the head of the bay to the city of Philadelphia.

The proposed improvement may be most conveniently investigated under two separate heads—first, the cost of forming the channel, and secondly, the probability of maintaining it at reasonable expense.

COST OF FORMING THE CHANNEL.

As before remarked, the cost of creating a channel of the dimensions proposed will vary greatly in different parts of the river, according to the character of the material, the method employed for its removal, and the distance to the place of deposit. Accordingly it has been found desirable to make a separate estimate for each of the sections into which the river has been divided.

Method of dredging.—The hydraulic method of excavating the material and depositing it in a semifluid condition above high water can doubtless be used to advantage in a considerable part of the work, but the limitations and uncertainties of the method make its adoption undesirable as a general basis for estimates. The economical application of this method requires that the lift should be low, the discharge pipe not too long, and the material not very hard. The cost of dredging by this method rapidly increases with the hardness of the material, the length of the discharge pipe, and the height of the lift. Moreover, a long discharge pipe can not generally be used without unduly obstructing the channel, which must be kept open for navigation during the progress of the work. Experience shows that it is not easy to obtain places for the deposit of material above high water without incurring heavy expenses for the construction or repair of meadow banks and for drainage, or to satisfy the demands of riparian owners. Accordingly the estimates are generally based upon the assumption that the material is to be excavated with dipper and grapple dredges and transported in scows to a suitable place of deposit. The fact that the hydraulic method may be used to advantage when the distance to the place of deposit is great has, however, been given due consideration in estimating the cost of the work in the higher sections of the river.

Place of deposit.—A large amount of material excavated for improvement has been deposited in the river, and very few places remain where material can now be deposited without danger of injury to the main channel. The amount of soft material which can be safely deposited in the river is so small, compared with the total amount to be removed, that for the purposes of estimating the cost of the work it may be assumed that the total amount of soft material excavated must be deposited in the bay beyond the limits of the river proper, or placed on shore above high water. Hard material, such as rock and gravel, which are too heavy to be moved by the bottom currents, may be deposited to advantage at places in the channel where the depths are now excessive. The nearest and best dumping ground in the bay is the deep hole just below Ben Davis Point Shoal, 6 miles below Ship John Light, in which all the material excavated in the improvement could be deposited without danger of injury to any navigable channel and without interference with riparian or fishing interests. The objection to this place of deposit is its distance from the greater part of the work, whereby the cost of transportation is much increased; but nearer dumping grounds of sufficient capacity do not exist.

Computation of quantities.—For each section the quantity of material to be dredged in cubic yards, place measurement, has been computed for a channel 600 feet wide and 30 feet deep at mean low water, with side slopes of 1 on 10 and an allowance of 1 foot for undercut. This quantity has been increased 25 per cent to reduce it to scow measurement. This allowance is very liberal, but is considered necessary to provide for shoaling during the progress of the work. Rock in place has been found within the limits of the proposed channel at Schooner Ledge only, but it is possible that it may be discovered in small quantities during the progress of the work. Its removal is estimated for at Schooner Ledge only, where it is proposed to excavate the channel to a depth of 31 feet. An estimate, however, is submitted for the removal of the isolated rock near Petty Island.

Unit prices.—The price per cubic yard for dredging and depositing material has been determined carefully for each section separately, the distance from the place of deposit and the possibility of using the hydraulic method being given due consideration. The price varies from 10 cents per cubic yard in the lower section to 20 cents per cubic yard in the higher sections of the river. No additional allowance has been made for dredging hard material, as it will be found almost exclusively in the higher sections of the river, and the increased cost of its excavation will be fully compensated for by the diminished cost of its transportation, since it can be deposited in parts of the channel where the depths are excessive.

The price for excavating and removing rock from the channel at Schooner Ledge and Petty Island is estimated at $9 per cubic yard, measured in place, which is the price formerly paid for the removal of rock from Philadelphia Harbor.

Section 1.—This section extends from deep water at the head of the bay, opposite a point a little below Bombay Hook, to opposite Elsingboro Point, about a mile and a half above Reedy Island. The length of the section, measured along the line of mid-channel, is 14.3 miles. In its original condition the channel had a minimum depth of about 19 feet at mean low water. During the past year it has been improved by the dredging of about 3,400,000 cubic yards of material, scow measurement, and the channel now has a minimum depth of 26 feet, with a varying width of from 400 to 600 feet. The material is soft mud mixed with sand, with occasionally stiff mud and the shells of abandoned oyster beds, all of which can be easily removed by dredging. The average distance of the section from the dumping ground is 20 miles. The cost of dredging in this section is estimated at 10 cents per cubic yard, scow measurement. The estimated quantity of material to be removed is 8,207,000 cubic yards, scow measurement. The total cost of forming the channel in this section is therefore estimated at $820,700.

Section 2.—This section extends from Elsingboro Point to Fort Delaware. The length of the section, measured along the line of mid-channel, is 3.56 miles. The channel has a minimum depth of about 23 feet at mean low water, but its improvement to a depth of 26 feet is provided for by an existing contract. The material is a mixture of mud and sand, which can be easily removed by dredging. The estimated quantity of material to be removed is 3,010,000 cubic yards, scow measurement. The average distance to the dumping ground is 30.45 miles. The cost of dredging is estimated at 12½ cents per cubic yard, scow measurement.

The total cost of forming the channel in this section is estimated at $376,250.

Section 3.—This section extends from Fort Delaware to Deep Water Point, New Jersey. The length of the section, measured along the line of mid-channel, is 8.61 miles. In its original condition the channel had a minimum depth of about 20 feet at Bulkhead Bar, but it has been greatly improved by dredging and dike construction, and it now has a minimum depth of 26 feet. The material is mud, hard sand, and some gravel, all of which can be removed by dredging. The estimated quantity of material to be removed is 3,992,000 cubic yards, scow measurement. The average distance to the dumping ground is 36.8 miles. The cost of dredging is estimated at 14½ cents per cubic yard, scow measurement.

The total cost of forming the channel in this section is estimated at $578,840.

Section 4.—This section extends from Deep Water Point, New Jersey, to Oldmans Point, New Jersey. The length of the section, measured along the line of mid-channel, is 5.50 miles. In its original condition the channel had a minimum depth of about 18 feet at mean low water. It was improved in 1884 by dredging the channel to a depth of 24 feet at mean low water over a width of 470 feet. Again, in 1893, this channel was dredged 400 feet wide and to a depth of from 25 to 27 feet at mean low water. During the past season it has been dredged to a depth of 26 feet over a width of 240 feet, and it now has a minimum depth of 25.2 feet. The material is soft mud, all of which can be removed by dredging. The estimated quantity of material to be removed is 6,689,000 cubic yards, scow measurement. The average distance to the dumping ground is 43.93 miles. The cost of dredging is estimated at 15½ cents per cubic yard, scow measurement.

The cost of forming the channel in this section is estimated at $1,036,795.

Section 5.—This section extends from Oldmans Point, New Jersey, to Marcushook, Pennsylvania. The length of the section, measured along the line of mid-channel, is 4.49 miles. In its original condition the channel had a minimum depth of about 25 feet at mean low water. The material is mud and sand, all of which can be easily removed by dredging. The estimated quantity of material to be removed is 4,176,000 cubic yards, scow measurement. The average distance to the dumping ground is 48.93 miles. The cost of dredging is estimated at 17 cents per cubic yard, scow measurement.

The cost of forming the channel in this section is estimated at $709,920.

Section 6.—This section extends from Marcushook, Pennsylvania, to the head of Chester Island, opposite the city of Chester. Its length, measured along the line of mid-channel, is 4.47 miles. In its original condition the channel in this section had a minimum depth of 24 feet at mean low water, this least depth being at Schooner Ledge, where the width was only 45 feet. In 1883 and 1889 the channel was widened to 330 feet.

The city of Philadelphia is now improving the channel at Schooner Ledge in accordance with the plans of the War Department, by permission of the Secretary of War, and under the supervision of the engineer officer in charge of the district. The contract of the Philadelphia department of public works, under which the work now in progress is being executed, provides for the improvement of the channel to a depth of 26 feet at mean low water over a width of 600 feet.

The material to be removed from this section is rock, bowlders, gravel, sand, and mud. After the work undertaken by the city has been completed, it will be necessary to excavate 59,500 cubic yards of rock in place, and dredge 3,086,000 cubic yards, scow measurement, of bowlders, gravel, sand, and mud, to form the 30-foot channel through this section.

The average distance of this section from the place of deposit is 53.33 miles. The price of rock removal is estimated at $9 per cubic yard, measured in place, and the price of dredging at 19 cents per cubic yard, scow measurement.

The cost of rock removal in this section is estimated at $535,500, and the cost of dredging at $586,340.

Section 7.—This section extends from the head of Chester Island, opposite the city of Chester, Pa., to the head of Tinicum Island, nearly opposite Billingsport, N. J. The length of the section, measured along the line of mid-channel, is 4.60 miles. In its original condition the channel had a minimum depth of 24 feet at mean low water. The material is mud and sand, all of which can be easily removed by dredging. The estimated quantity of material to be removed is 1,480,000 cubic yards, scow measurement. The average distance to the dumping ground is 57.85 miles. The price of dredging is estimated at 20 cents per cubic yard, scow measurement.

The cost of forming the channel in this section is estimated at $296,000.

Section 8.—This section extends from the head of Tinicum Island to Eagle Point, New Jersey, nearly opposite the head of League Island. The length of the section, measured along the line of mid-channel, is 5.29 miles. In its original condition the channel had a minimum depth of 17 feet, but it has been greatly improved by dredging and dike construction, and it now has a minimum depth of about 23 feet at mean low water.

The city of Philadelphia has been authorized by the Secretary of War to improve the channel through this section in accordance with the plans of the War Department and under the supervision of the engineer officer in charge of the district. The contract of the Philadelphia department of public works, under which the work will be conducted, provides for the formation of a channel 600 feet wide and 26 feet deep at mean low water.

The material is mud and sand. After the work to be done by the city has been completed, it will be necessary to dredge 1,366,000 cubic yards of material, scow measurement, to form the 30-foot channel through this section.

The average distance to the dumping ground is 62.8 miles. The price of dredging is estimated at 20 cents per cubic yard, scow measurement.

The cost of forming the channel in this section is estimated at $273,200.

Section 9.—This section extends from Eagle Point, New Jersey, nearly opposite the head of League Island, to opposite Christian street, Philadelphia, where it meets the 30-foot channel of the harbor. The length of the section, measured along the line of mid-channel, is 5.22 miles. In its original condition the channel had a minimum depth of 18 feet at mean low water near Christian street, but it has been deepened to 28 feet in the improvement of the harbor. The material is mud and sand. The estimated quantity to be removed is 369,000 cubic yards, scow measurement.

The average distance to the dumping ground is 68 miles. The price of dredging is estimated at 20 cents per cubic yard, scow measurement.

The cost of forming the channel in this section is estimated at $73,800.

ROCK OPPOSITE PETTY ISLAND.

The removal of this rock to a depth of 26 feet at mean low water will require the excavation of about 12,100 cubic yards of material, place measurement, which, at $9 per cubic yard, will cost $108,900.

The estimated total cost of forming a channel 600 feet wide and 30 feet deep at mean low water from Philadelphia to deep water in Delaware Bay, including the removal of the rock near Petty Island, is as follows:

For dredging	$4, 751, 845
For rock removal	644, 400
	5, 396, 245
Engineering and contingencies	538, 755
Total	5, 935, 000

The estimated total amount of material to be removed by dredging is 32,375,000 cubic yards, scow measurement. This estimate is necessarily approximate, since the bed of the river is constantly changing, shoaling in some places and deepening in others. In my judgment, however, the quantity to be removed will not exceed this estimate, and it may be reduced by scour during the progress of the improvement.

Under the most favorable conditions the execution of the project will require about six years. To conduct the work successfully and economically, it should be done under a continuous contract. The above estimate of cost is based upon the assumption that the improvement is to be executed by this method.

MAINTENANCE OF THE CHANNEL.

In previous projects for the improvement of the Delaware River, the greatest depth of channel contemplated has been 26 feet at mean low water, this being heretofore considered the greatest depth required by commerce. The greatest depth which could probably be maintained at reasonable cost might perhaps be determined by a study of the river itself, if the form and dimensions of the channel were solely the result of the action of flowing water, but this is not the case. Natural obstructions, immovable by water, such as the rock at Schooner Ledge, exist in some parts of the channel; and in other places, where bars have persistently formed, old wrecks and other artificial obstructions, deeply embedded in the material of the bottom, have been found by dredging. Such artificial obstructions have been removed at Five-Mile Bar, Smith Island Bar, Bulkhead Bar, and Reedy Island Bar, and doubtless other obstructions of a similar character will be discovered as the improvement of the channel progresses. For this reason the various attempts heretofore made to determine the theoretical form and dimensions of an improved channel in the Delaware River from a study of the existing cross sections have been found after careful examination to be of little practical value.

Although the Delaware River is not classed as a sediment-bearing stream, a large quantity of material is annually brought into its channel by the waters of its tributaries and by the erosive action of freshets and ice upon its banks. Part of this material is carried by the ebb currents to the bay, part is deposited on the slopes and in the side channels, where it does not obstruct navigation, and part is deposited in the main channel, where it tends to form bars and may have to be removed by dredging. It is evident that the total amount of material thus brought into the river will not be increased by deepening the channel, and that by such deepening the power of the ebb currents to remove deposits will be increased.

A very important cause of channel deterioration is the movement of material from the bed of the river by cross currents. If the maximum ebb and flood currents followed the same paths, the location and maintenance of an improved channel would be comparatively easy. But these tidal currents generally follow different paths, and at the turnings of the tide currents are developed which flow in all conceivable directions. No matter how the channel may be located, at various times in the tidal day it will be subjected to the action of cross currents tending to form deposits by moving the material from the slopes.

Since the conditions favoring shoaling vary greatly in different parts of the river, they must be considered in detail in order to form a reasonable idea of the results to be expected in an improved channel. The mean range of the tide at the entrance of Delaware Bay is 4.5 feet. The marine tide wave enters the bay between the capes and flows to the head of the bay, its mean range gradually increasing until it attains its maximum of 6.1 feet at Bombay Hook. The mouth of the river may be considered as at this point, and here the fluvial tide commences. During the flood tide water from the bay pours into the river, and some of this water flows upstream for about 15 miles, and sometimes for a much greater distance. For all practical purposes, however, the upper limit of this inflow may be assumed at Pea Patch Island. In this lower part of the river, which is subject to the inflow of water from the bay, the flood wave is not merely a transmitted form of energy, but also an actual flow of water due to a head. Above the upper limit of this inflow—that is, above Pea Patch Island—the tidal conditions are essentially different. In these upper sections of the river there is practically no inflow of water during the flood, the tide wave being merely a transmission of energy in which the particles of water are moved for short distances only.

The compartment of the river which is subjected to the inflow of water from the bay during the period of the flood tide is covered by sections 1 and 2, described above. In these sections, especially in the lower one, the conditions are most favorable for shoaling. The river is very wide and greatly exposed to the severe action of storms. The channel occupies a very small part of the width of the bed. During the period of the flood, water from the marine wave pours into the channel, bringing with it material eroded from the shores and bottom of the bay. At the turning of the tide cross currents scour the broad expanse of the river's bed in every direction, and here material brought down in suspension by the outflowing waters of the ebb is most likely to be deposited should it fail to reach the bay. The shoals extending throughout the lower section of the river constitute the bar at its mouth, and whether a channel 30 feet deep at mean low water can be maintained through this bar at reasonable expense can only be determined by actual trial. It is to be observed, however, that the lowering of this bar would increase the velocity of propagation of the head of the flood, and thereby increase the power of the tidal currents for channel maintenance.

In all the sections of the river above Pea Patch Island, except section 4, the conditions seem favorable to the maintenance of a 30-foot channel at reasonable cost. This part of the river is not subjected to the action of inflowing water from the marine wave, and it is believed that its improved channel could be easily maintained. In section 4 the existing conditions greatly complicate the improvement of the channel.

At the foot of the section the width of the river is contracted by the projection of Deep Water Point, and the inflowing waters of the Christiana River, from the opposite shore, disturb the movements of the tidal currents and deposit sediment in the channel. In this section the river is separated into two channels by Cherry Island Flats. The western channel, which lies along the Delaware shore, has been improved from time to time since 1879 with varying degrees of success. Sometimes the improved depth has been maintained for several years and at other times the channel has shoaled rapidly. It can not be doubted that the permanency of this part of the channel would be greatly increased if it were dredged to a depth of 30 feet; and if the Delaware shore were advanced by bulkheading and filling in with dredged material the conditions for maintenance would be still further improved and the city of Wilmington would obtain a magnificent water front on the Delaware River.

In connection with this question of channel maintenance, it may be asked whether the depths could not be maintained by the construction of dikes properly located to direct the currents and confine their action within the limits of the channel. The original project of the Board of Engineers of 1885, in general accordance with which the improvement of the Delaware River has been thus far conducted, provided for a very large amount of dike construction. Dikes have accordingly been built at Five-Mile Bar, Mifflin Bar, and Bulkhead Bar, and they have admirably fulfilled the purposes for which they were designed. It will be observed, however, that these dikes are all located in the part of the river above the limit of effective inflow of the waters of the marine tide wave. In the lower part of the river the conditions for dike construction are much less favorable. The dikes would have to be of great length. They would be difficult and very expensive to construct, on account of the softness of the bottom, and they would have to be located with the greatest skill and care to avoid obstructing the inflow of the flood tide. Owing to the action of ice and storms these structures would require large expenditures for annual repairs. Moreover, it has been found practically impossible to locate and construct such works on the lower part of the river on account of the real or fancied grievances of riparian owners. Accordingly the Board of Engineers of 1896 recommended the abandonment of dike construction in this part of the river and the improvement of the channel by dredging. When the Board of Engineers of 1885 submitted its report, the cost of dredging was relatively so great as to amply justify the expense of dike construction. With the improved dredging machinery and low prices of the present time the construction of dikes is no longer generally considered advisable for the improvement of a bar within the mouth of a tidal river.

To summarize my views on the question of maintenance: I am of the opinion that the practicability of maintaining a channel 30 feet deep at mean low water at reasonable cost from the mouth of the river to Pea Patch Island can only be determined by trial, and that such a channel could undoubtedly be maintained at reasonable cost above Pea Patch Island, except at Cherry Island Flats, where there is reasonable ground to hope for success.

The deepening of the channel of the Delaware River to 30 feet at mean low water would undoubtedly be a great benefit to navigation, even were it found by experience impossible to maintain the full depth in all parts of the channel at reasonable cost. It would clear the channel of all compact material and artificial obstructions, and thus enable the tidal currents to exert their action to the best advantage for the maintenance of the improved depths. Should extensive shoaling occur, it would probably be at the bar within the mouth of the river, where a deficiency in depth would be the least obstruction to navigation. The material constituting the shoals would be so soft that it would form little or no obstruction to the passage of steamships, and would not injure the bottoms of vessels.

The results of the work already done for the improvement of the channel of the Delaware River from Philadelphia to the bay are of the most encouraging character. At Five-Mile Bar, where there was formerly a minimum depth of 3 feet, and where it was expected that the improvement would create a depth of 12 feet, a permanent channel with a depth of 26 feet at mean low water has been obtained. Between this point and Kaighn Point, covering that part of the river called the harbor of Philadelphia, islands, shoals, and rocks have been removed, and there is now a channel having a least width of 1,000 feet and a least depth of 26 feet at mean low water. At Mifflin Bar, where there was formerly a minimum depth of 17 feet, there is now a minimum depth of about 23 feet at mean low water. The improvement at Bulkhead Bar, where there was formerly a minimum depth of 20 feet, has not only resulted in creating a depth of 27 feet at mean low water over the bar, but has also deepened the channel for a long distance above, through Pennsville Shoals, from 24 to 26 feet at mean low water. At Cherry Island Flats alone the results have not been perfectly satisfactory, yet the channel has been deepened from 18 to 26 feet at mean low water over a moderate width, and navigation has been decidedly benefited thereby. During the past year a channel 26 feet deep at mean low water was cut through the bar within the mouth and at Reedy Island, about 3,400,000 cubic yards of material being removed by dredging in a single working season. Time alone can determine the permanency of this improvement, but if this depth is maintained it will be of the greatest benefit to navigation.

The project now under consideration contemplates an improvement much greater than has ever been attempted in any tidal river of a similar character, and I have therefore found it necessary to be conservative in the prediction of probable results. Nevertheless, after an experience of nearly eight years in studying and executing improvements in this river, and in view of the satisfactory results already obtained, I feel justified in expressing the opinion that this project can be undertaken with a reasonable probability of success.

Respectfully submitted.

C. W. Raymond,
Major, Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

H 14.

SURVEY OF SCHUYLKILL RIVER, PENNSYLVANIA.

[Printed in House Doc. No. 346, Fifty-fifth Congress, second session.]

Office of the Chief of Engineers,
United States Army,
Washington, D. C., March 10, 1898.

Sir: I have the honor to submit the accompanying report of March 5, 1898, with map,* by Maj. C. W. Raymond, Corps of Engineers, of the results of a survey of Schuylkill River, Pennsylvania, made to comply with the requirements of the river and harbor act of June 3, 1896.

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*Not reprinted. Printed in House Doc. No. 346, Fifty-fifth Congress, second session.

This report contains a project for improvement of the river from its mouth to the head of navigation at Walnut Street Bridge by dredging and rock removal as follows:

1. *Lower section*, from outside the bar at the mouth to Penrose Ferry Bridge, a distance of about 1½ miles, to secure, by dredging, a channel having a bottom width of 400 feet and a depth of 26 feet at mean low water.
2. *Middle section*, from Penrose Ferry Bridge to Gibson Point, a distance of about 3 miles, to secure, by dredging, a channel having a bottom width of 390 to 400 feet, with a depth of 26 feet at mean low water.
3. *Upper section*, from Gibson Point to Walnut Street Bridge, to secure, by dredging and rock removal, a channel having a bottom width of 320 to 400 feet and a depth of 22 feet at mean low water.

The estimated cost of the work proposed is as follows:

Lower section	$433,000
Middle section, excluding work already provided for by the city of Philadelphia	1,140,000
	1,573,000
Upper section, excluding work already provided for by the city of Philadelphia	1,580,000
Total	3,153,000

Major Raymond states that occasional dredging will be required to maintain the channel; that the improvement of the lower section could be undertaken immediately and completed in about two years should sufficient funds be provided, but that the improvement of the middle and upper sections could not be commenced and executed to advantage until work under the contract of the city of Philadelphia has been completed.

In his letter transmitting this report Major Raymond says:

> In my opinion the lower and middle sections of the river, as defined in the project, are worthy of improvement, and their improvement is justified by the interests of commerce involved. The necessities of commerce are not, in my opinion, sufficient to justify the large expenditure required for improving the upper section at the present time.

Very respectfully, your obedient servant,

A. MACKENZIE,
Acting Chief of Engineers.

HON. R. A. ALGER,
Secretary of War.

REPORT OF MAJ. C. W. RAYMOND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., March 5, 1898.

GENERAL: In compliance with instructions contained in Department letter dated September 5, 1896, I have the honor to submit the following report upon a survey of the Schuylkill River, Pennsylvania, in accordance with a provision of the river and harbor act of June 3, 1896:

The Schuylkill River enters the Delaware River from the northward just below the city of Philadelphia and forms an important part of Philadelphia Harbor. It is crossed by the dam of the Fairmount Water Works at a distance of about 8.57 miles from the mouth. The head of navigation for large vessels is at the Walnut Street Bridge, which is without a draw and about 7.39 miles from the mouth.

In its original condition before improvement the channel over the bar at the mouth of the river had a depth of about 10 feet at mean low water. From the bar to Gibson Point, a distance of about 4½ miles, the ruling depth was about 16 feet at mean low water.

The improvement of this river has been in progress at intervals since 1870, when the original project was adopted. Under this project, which was modified in 1875, 1885, and 1892, 1,660,064 cubic yards of material, scow measurement, have been dredged from the channel and dikes have been constructed at the mouth. This work has resulted in the formation of a channel from 100 to 160 feet wide and from 24 to 28 feet deep at mean low water across the bar at the mouth and a channel from 200 to 300 feet wide and from 20 to 24 feet deep at mean low water from the bar to Gibson Point. The project is completed with the exception of a little work on the dike and a little dredging at the mouth, which will be done with funds now available. The total amount heretofore appropriated for this improvement is $525,000.

The improvement has been of great value to the port of Philadelphia. The deep-draft grain and oil vessels which now navigate the river to Gibson Point could not have entered it in its original condition, even at the highest stage of the tide.

The present survey, which extends from the mouth of the river to the head of navigation at the Walnut Street Bridge, was made under my direction by Mr. R. G. Pearson, United States surveyor. A copy of his report and an accompanying map of the survey are transmitted herewith.

During the past two years the city of Philadelphia has been engaged in improving the channel of the river under authorities of the Secretary of War dated September 3, 1895, and May 14, 1896. The project of the city contemplates the formation of channel depths of 22, 20, and 18 feet in parts of the river between the Penrose Ferry and Walnut Street bridges. Up to the present time about 38,900 cubic yards of material, as measured in the dump, have been removed and deposited on shore above high water.

PROJECT FOR IMPROVEMENT.

In order to prepare a project for the further improvement of this river and estimate the cost thereof, as required by law, it is necessary to consider the needs of the commerce now existing and of that which may be expected in the near future.

The total freight movement upon the river during 1897 was 3,499,683 tons, and its value was estimated at $39,841,220. The traffic requiring transportation in deep-draft vessels is mainly confined to the lower 4½ miles of the river, from Gibson Point to the mouth. At Girard Point are located large grain elevators and wharves. At Gibson Point and Point Breeze, which are near each other and closely related as to commercial requirements, are the large storage tanks and wharves of the petroleum oil refineries. Both the grain and oil trade require deep-draft vessels for the convenient and economical transaction of their business. Between the mouth of the river and Gibson Point a channel depth is required which will permit the passage of vessels drawing 24 feet of water at all stages of the tide; that is, a depth of at least 26 feet at mean low water.

In the upper part of the navigable channel, from Gibson Point to the Walnut Street Bridge, there is a large traffic in chemicals, coal, stone, sand, and other heavy materials. A few of these interests desire the improvement of the channel to a depth of 24 feet at mean low water, but almost all could be amply accommodated by a depth of 22 feet. As the range of tide is about 6.3 feet, this would give a channel depth of 28.3 feet at mean high water. As this part of the river is crossed by five drawbridges, and as the channel contains much rock the removal of which would be very expensive, it has been considered best to limit the project for its improvement to a depth of 22 feet at mean low water.

For the purpose of convenient description and computation the navigable channel is divided into three parts—the lower, middle, and upper sections.

1. *Lower section.*—This section extends from the outside of the bar at the mouth to the Penrose Ferry Bridge, a distance of about 1½ miles. In this part of the river the grain trade is concentrated. The improvement already executed consists of an earthen and pile dike constructed on the west side of the channel, the objects of which were to prevent material from sliding into the channel from the flats or entering in suspension in the waters of the flood and to concentrate and intensify the action of the current in times of freshet. The tidal velocities at the mouth are too small to produce effective scour, while in the freshets, which are frequent and of short duration, the water flows over the bar with great velocity. It was therefore thought best to depend for channel maintenance upon the direction and concentration of the freshet current, even at the sacrifice of a part of the tidal volume of the river.

It was understood that the plans of the Navy Department contemplated the closure of the channel in rear of League Island by a causeway at its western end, and the dike was located accordingly. The causeway has not been built, and the dike will not produce its full effect until the channel referred to has been closed. The dike is now being raised, as it was found to be too low to fully control the highest freshet waters. The results already obtained justify the conclusion that the work is a practical success and that a channel depth of at least 26 feet at mean low water can be maintained over the bar. The channel over the bar has already been improved to the extent of more than two and one-half times its original depth.

The projected channel through this section has a bottom width of 400 feet and a depth of 26 feet at mean low water. Its formation requires the removal of 1,638,800 cubic yards of material, place measurement. This material is principally mud, and can be easily removed by dredging.

All the soft material dredged from the river will have to be deposited on shore above high water, since there is no place, either in the Schuylkill or the Delaware River, where it can be deposited without danger of injury to the channel. Hard material like gravel may be deposited in the river without injury. Under these conditions the cost of dredging is estimated at 24 cents per cubic yard, measured in place before excavation. This is equivalent to about 20 cents per cubic yard, scow measurement.

The total cost of dredging in this section is estimated at $393,312.

2. *Middle section.*—This section extends from Penrose Ferry Bridge to Gibson Point, a distance of about 3 miles. This part of the river is navigated by the large vessels used in the oil trade. It is not crossed by bridges. The projected channel through this section has a bottom width of 390 to 400 feet and a depth of 26 feet at mean low water. Its formation requires the removal of 4,398,400 cubic yards of material, place measurement. The contract of the city of Philadelphia

provides for the removal of about 79,800 cubic yards of this material, leaving 4,318,600 cubic yards to be provided for under this project. The material is mud, sand, hard cemented gravel, and bowlders, all of which can probably be removed by dredging. No rock in place has been discovered in this section. The cost of dredging is estimated at 24 cents per cubic yard, measured in place before excavation, which is equivalent to about 20 cents per cubic yard, scow measurement.

The total cost of dredging in this section, exclusive of work already provided for by the city of Philadelphia, is estimated at $1,036,464.

3. *Upper section.*—This section extends from Gibson Point to Walnut Street Bridge. This part of the river is navigated by vessels carrying stone, coal, ice, chemicals, and other heavy materials. It is crossed by five drawbridges. The projected channel through this section has a bottom width of 320 to 400 feet and a depth of 22 feet at mean low water. Its formation requires the removal of about 2,044,500 cubic yards of material, place measurement. The contract of the city of Philadelphia provides for the removal of about 112,860 cubic yards of this material, leaving about 1,931,640 cubic yards to be provided for under this project. It is estimated that about 1,831,940 cubic yards of this material consist of mud, sand, gravel, and bowlders, which can be removed by dredging, and about 99,700 cubic yards consist of rock in place, which will require blasting. The cost of dredging is estimated at 24 cents per cubic yard, measured in place before excavation, which is equivalent to about 20 cents per cubic yard, scow measurement, and the cost of rock removal at $10 per cubic yard, place measurement.

The total cost of dredging and rock removal in this section, exclusive of work already provided for by the city of Philadelphia, is estimated at $1,436,666.

In computing the amount of material to be removed in this section it has been assumed that the channel will be made as wide as the established pierhead lines will permit. In some places it may be necessary to make the width of the channel a little narrower to insure the safety of existing wharves. In this case the estimated quantities will be somewhat reduced.

SUMMARY.

The total cost of executing the entire improvement is as follows:

Lower section:		
Dredging	$393, 312	
Contingencies	39, 688	
Total		$433, 000
Middle section:		
Dredging	1, 036, 464	
Contingencies	103, 536	
Total		1, 140, 000
Upper section:		
Dredging and rock removal	1, 436, 666	
Contingencies	143, 334	
Total		1, 580, 000
Total cost of improvement		3, 153, 000

The improvement of the lower section could be undertaken immediately and completed in about two years, should sufficient funds be provided.

The improvement of the middle and upper sections could not be commenced and executed to advantage until work under the contract of the city of Philadelphia has been completed.

The dam of the Fairmount Water Works forms a settling basin, so that very little material is brought down by the backwater during ordinary stages of the river. A large amount of material is brought down in suspension during freshets, but the current velocities are then so great that very little of it is deposited in the channel. Some shoaling is produced by scour along the shores and over the flats, and the maintenance of the channel will require occasional dredging. If a channel of the dimensions provided for in this project were formed, it is considered probable that it could be maintained at reasonable cost.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. R. G. PEARSON, SURVEYOR.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., February 7, 1898.

MAJOR: I have the honor to submit the following report upon a survey of the Schuylkill River, Pennsylvania, from its mouth to the head of deep-water navigation at Walnut Street Bridge, together with a chart of the river, showing the triangulation points, shore lines, and depths at mean low water.

The survey was commenced early in December, 1896, and a triangulation was carried from the mouth of the river upstream to Harrison's Paint Works, above Grays Ferry. The shore lines on both sides of the stream were located throughout the same distance. The work was then discontinued (December 23, 1896) because of the rapid formation of ice. Resumed December 17, 1897, the triangulation was completed to the Arsenal Bridge and thence a traverse to Walnut street. The shore lines above Harrison's wharf were located, thus completing the topography, and the hydrography from the confluence with the Delaware River to Walnut Street Bridge was taken by means of cross sections at frequent intervals, normal to the axis of the stream. In addition, a few borings were made where a rocky bottom was suspected, to wit, above Harrison's wharf and above and below the South Street Bridge.

In the course of the survey, which had an extent of $7\frac{1}{4}$ miles, 38 permanent triangulation stations, consisting for the most part of 1-inch iron pipes, 4 feet long, sunk vertically in the ground, their tops 1 foot below the surface, were established at short intervals along both sides of the river. These stations have been witnessed in such a manner as to permit of their easy recovery at any time. Twelve permanent bench marks have also been set at convenient localities and their elevations above mean low water determined by simultaneous tidal comparison, under favorable conditions, with the standards at Fort Mifflin and League Island. Detailed descriptions of the aforesaid stations and bench marks have been furnished the office. Two hundred and sixty cross sections, approximately 125 feet apart and comprising 3,685 soundings, were run, and 14 miles of shore line were located. The actual total number of working days was 28, showing a mean daily progress of 1,335 feet. The total cost of the survey was $1,078 (including coal and general supplies).

The tide was observed on a calm day, during one whole flood, at gauges about 9,000 feet apart between the mouth of the river and Fairmount Dam. Assuming the mean rise and fall at the mouth to be 6 feet, the observations show the mean range at Penrose Ferry Bridge to be 6.05 feet; at Point Breeze, 6.15 feet; at the Baltimore and Ohio Railroad Bridge, 6.3 feet; at South street, 6.35 feet; and at a point 2,000 feet below the dam the mean rise and fall is 6.4 feet, the wave displaying a gradual increase in height as it is propagated upstream. Near the dam, shortly after the commencement of flood tide, there is to be noted a secondary wave; for after the first 3.5 feet of rise a short stand occurs and then a fall of 0.1 foot, more or less, followed by another stand, after which the rise to high water is unbroken though very gradual. At South street this secondary wave is evidenced by a slight fall after the first 3 or 4 feet of rise, and at the Baltimore and Ohio Railroad Bridge it takes the form of a stand, lasting from 20 to 40 minutes. Below here it is not appreciable.

During the first hour of the flood tide the water rises very rapidly, the maximum rate at the dam being 0.5 foot in five minutes, and at the Penrose Ferry Bridge 0.25 foot in the same period. From the Baltimore and Ohio Bridge upward the very rapid rise takes place before the occurrence of the secondary wave. In spite of this quick flood tide, however, the slope of the front of the advancing wave is very slight, amounting only to about 0.15 foot per mile between Girard Point and Point Breeze, above which place it is even less, becoming toward high water a slope in the opposite direction, owing to the greater rise of the tide near the dam. It is to be noted that after the occurrence of the secondary wave from the Baltimore and Ohio Bridge upward, the water surface becomes nearly parallel to the plane of mean low water and continues so to rise. Agreeably to the small surface slope just mentioned, there is but a very feeble flood current. The water surface of the entire river rises and falls nearly simultaneously, much as in a long dock.

Low water occurs at the same time both at the mouth and at Penrose Ferry Bridge; it is ten minutes later at Point Breeze, fifteen minutes later at the Baltimore and Ohio Bridge, twenty-two minutes later at South street, and thirty minutes later at the dam than at the mouth. High water occurs five minutes later at Penrose Ferry Bridge than it does at the mouth, eighteen minutes later at Point Breeze, and twenty-eight minutes later at the Baltimore and Ohio Bridge. At the latter place, South street, and the dam, high water occurs simultaneously.

Except during freshets, the currents, both flood and ebb, are very sluggish, and often are altogether inappreciable. The water runs down until fifteen minutes after low tide; slack water endures for ten minutes. The flood current at Point Breeze, the Baltimore and Ohio Bridge, and South street commences to run about twenty minutes after low tide, and continues feebly for three hours, or until one and one-fourth hours of high water, when it turns downward again after a short stand. In the vicinity of the dam there is no flood current, the only suggestion of it being a period of slack water. The intensity of the currents and the presence or absence of a flood current necessarily depend largely upon the amount of water flowing over the dam. During freshets the outward current is so strong that tugboats can hardly stem it; but for nine months of the year the water surface simply rises and falls, having but little horizontal motion. During the summer and fall the material flowing in the Schuylkill River is so largely composed of sewage and other waste products from the various factories along the shores, that it is quite unlike water, being of a light-gray color and having a greasy sheen. This results from the fact that the fresh-water discharge and tidal currents are insufficient to cleanse the stream at that season. The same fluent continues oscillating within narrow limits, depositing its heavier constituents upon the bottom of the river, producing the many soft shoals.

Freshets occasion abnormal variations in the water level. Thus, at Point Breeze and just below the Baltimore and Ohio Bridge the highest observed water level is reported as being 12 feet above mean low water, or double the height of an average high tide. Ordinary freshets reach a level 10 feet above mean low water. Above Grays Ferry, owing to the obstruction occasioned by the bridge there and the Baltimore and Ohio Bridge below, the freshet of 1894 attained a height of 17 feet above mean low water, exceeding the tops of the wharves and bulkheads in the vicinity of South street by 5 feet or more. The ordinary flood level in this neighborhood is, however, only 12 feet above mean low water, or just even with the cap logs of the bulkheads. During freshets, as previously stated, the current runs with torrential velocity.

The dikes protecting the lowlands on both shores of the river from Point Breeze to its mouth are in a state of good preservation, many of them having been recently repaired. The shores in front of the dikes consist generally of gentle slopes of very soft mud, overgrown in summer with aquatic plants. In several localities along the lower river extensive reclamation projects are in process of execution, the material being pumped over the dikes by means of hydraulic dredgers. Above and below the Baltimore and Ohio Bridge extensive outcrops of solid rock project beyond the general shore line of the river, dropping off very steeply into deep water. Opposite these rocky shores, however—that is, between Gibson's wharf and the Baltimore and Ohio Bridge, and between the latter and Grays Ferry Bridge—no exposed rock is evident on the bed of the stream. The river bottom generally between Penrose Ferry Bridge and Gibson Point would seem to consist of gravel overlaid by more or less mud, as shown, at least, by the material raised by dredgers working there. At the latter point several large stones were raised, and at Point Breeze there is a ridge of compact gravel.

Just below Grays Ferry Bridge, where the channel is much contracted, freshets have scoured a hole over 50 feet deep, the bottom of which appears gravelly. Above Harrison's wharf, on the right-hand bank, there is a rocky ledge that extends out under the bed of the river for one-half its width, forming a bottom of solid rock, and contracting the 12-foot channel to 180 feet for a distance of 400 feet. The channel west of this ledge, possessing a least depth of 17.7 feet at mean low water, has a bottom consisting of small stones in a matrix of soft mud to a depth of 2 feet. This submerged rocky area is terminated with remarkable regularity by a line parallel to the axis of the stream midway between the low-water lines. Near its downstream termination the rock seems fractured, as though large pieces had been detached from the main mass. Rock was reported to exist between the Pennsylvania Railroad Bridge at Schuylkill Arsenal and South Street Bridge, but a few borings in that locality failed to reveal any, the bottom for a depth of 2 or 3 feet proving to consist of stones of various sizes, mostly small, scattered through a muddy matrix, forming a sort of soft gravel.

Above South street, however, there is a ledge of solid rock extending 80 feet out from the bulkhead on the east side of the river for a distance axially of 700 feet, or from Locust street nearly to Pine street. The depth on this ledge varies from 18 feet at its lower to 17 feet at its upper end, at a distance of about 70 feet from the bulkhead, which is evidently founded upon it. The surface of the ledge is rather irregular, and toward its lower extremity—i. e., below Spruce street—it is fissured as though blasting operations had at one time been conducted there. The bed of the western side of the channel above South street, and bordering the rocky ledge just described, consists of firm gravel. The edge of the rocky area is well defined, being marked by a plane parallel to the axis of the river.

The wharves and bulkheads forming the shore lines in many places are all in first-class condition, being repaired as necessity demands. There are very few open wharves; they are for the most part constructed exactly like the bulkheads—that is, with a timber crib work, with earth filling resting upon piles sawed off at the level of low water.

All the bridges below the Walnut Street Bridge, which is a fixed bridge, with a clearance above mean low water of 28 feet, are provided with swing or draw spans. At the Penrose Ferry Bridge there are two openings, each having a clear width of 178 feet, and the clearance under the swing span, when closed, is 24 feet at mean low water. The Baltimore and Ohio Railroad Bridge has a swing span with a clear opening on each side of 57 feet, and an overhead clearance at mean low water of 22 feet, although the floor beams of the fixed span east of the draw are so arranged as to give a clearance of 24 feet. The Grays Ferry Bridge, an antiquated wooden structure, is provided with a primitive draw, moving back and forth on rollers fixed in the western abutment. It affords a clear opening of 45 feet between the floating fenders, and, when closed, an overhead clearance of 26 feet at mean low water. The massive piers of this bridge, situated in a narrow portion of the river, act as a sort of dam to the flood waters, and the new bridge now being constructed only 200 feet farther upstream will enhance this effect, will raise the flood level along the reaches above, and in addition it will be extremely awkward at times for shipping men to pass through two drawbridges so very close together. The Pennsylvania Railroad Bridge at the arsenal has a swing span with two openings, the western one 68 feet wide and the eastern one 73 feet wide, and a clear height above mean low water of 32 feet. South Street Bridge provides two openings of 70 feet each and a clearance of 38 feet above mean low water.

The Penrose Ferry, Baltimore and Ohio, and Grays Ferry bridges are provided with proper timber fenders around the masonry piers on both sides of the draw openings. At the Arsenal Bridge, however, the pier on the east side of the eastern opening has no fenders, so that vessels passing through are in danger of striking the masonry should they become unmanageable. The other piers of this bridge are sufficiently protected. In the case of the South Street Bridge, neither of the side piers has fenders, and the solid masonry ice breakers at the upper and lower ends of the crib work guarding the swing-span pier are unprovided with timber fenders. As these ice breakers present sharp vertical edges to the channel, they form a constant menace to vessels passing through the draw, for a wooden boat striking them would inevitably be damaged. The omission is made more glaring by the fact that exactly similar masonry ice breakers recently constructed at the Penrose Ferry Bridge have been furnished with outstanding timber fenders.

A comparison of the chart prepared from this survey with one made in 1879 shows that the river is undergoing very little change. The silt deposited from the excessively dirty water is evidently scoured away by the freshets of the following spring, this circumstance enabling the river to maintain a nearly constant regimen.

In conclusion, I would respectfully suggest that the annual examination of the stations and bench marks established in the course of this survey be made the subject of a general order. The triangulation is generally the most expensive part of a survey, and if the results are to be permanent the stations must be maintained. To do this would require about two days. Also, some of the hemlock witness posts to stations should be replaced by oak posts at the earliest opportunity.

Submitting the above report, together with a chart of the river in two sections and descriptions of all stations and bench marks, I remain,

Very respectfully, your obedient servant,

R. G. PEARSON, *Surveyor*.

Maj. C. W. RAYMOND,
Corps of Engineers, U. S. A.

H 15.

SURVEY OF MANTUA CREEK, NEW JERSEY.

[Printed in House Doc. No. 123, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 2, 1897.

SIR: I have the honor to submit the accompanying report, of October 22, 1897, with map,* by Maj. C. W. Raymond, Corps of Engineers, of the results of a survey of Mantua Creek, New Jersey, made to comply with provisions of the river and harbor act of June 3, 1896.

The improvement proposed by Major Raymond is to secure a channel 100 feet wide at bottom and 12 feet deep from the 12 foot contour in Delaware River to the phosphate works; thence 80 feet wide at bottom and 8 feet deep to Paulsboro; thence 60 feet wide at botton and 7 feet deep to Parkers Landing, and to construct, 9,000 feet above Berkeley, a cut-off 350 feet long, 50 feet wide, and 3 feet deep, and to remove overhanging trees above Parkers Landing.

Two plans for securing such a channel have been considered by Major Raymond. The first contemplates the formation of a dredged channel by making cut offs, six in number, through the lowlands wherever practicable, avoiding shoals and sharp bends, and the second provides for widening and deepening the present waterway by dredging. The former plan is the one desired by the people of Paulsboro, as it shortens the distance between that place and the mouth of the creek nearly 2 miles.

The first plan will require an estimated expenditure of $112,630, provided all rights of way can be secured to the United States and riparian rights quieted for a sum not to exceed $11,000; and the second plan $109,000. In the event of jetties being required at the mouth of the creek these estimates will be increased to $145,030 and $141,400, respectively.

Major Raymond is of the opinion that the creek is worthy of improvement, and that its improvement is justified by the interests of commerce involved.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. R. A. ALGER,
Secretary of War.

REPORT OF MAJ. C. W. RAYMOND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., October 22, 1897.

GENERAL: In compliance with instructions contained in Department letter dated September 5, 1896, I have the honor to transmit herewith a copy of a survey of Mantua Creek, New Jersey, made in accordance with a provision of the river and harbor act of June 3, 1896, by Robert Schmitz and R. G. Pearson, surveyors, and also to submit the following project for improvement:

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* Not reprinted. Printed in House Doc. No. 123, Fifty-fifth Congress, second session.

This stream rises in Gloucester County, pursues a northwesterly course, and enters the Delaware River at a point 3 miles below League Island and opposite Mifflin Bar.

It is navigable at high water for a distance of one-half mile above its mouth to the phosphate works of the I. P. Thomas & Sons Co. for vessels of 13 feet draft; thence 3¼ miles farther to Paulsboro for vessels drawing 9 feet; thence 3.4 miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua (11¼ miles from the mouth) small boats and barges of 3 to 4 feet draft pass up on the tide.

The navigable portion, when it leaves fast land, winds through meadows lying 3 to 4 feet above low water and protected from overflow by earth banks. The general course of the stream is tortuous, and its navigation is much obstructed by bars, sharp bends, and in the upper portions by stumps and overhanging trees. The bottom is principally sticky mud and sand, with occasional gravel and small stones.

The stream, on account of its flat watershed, is subject only to moderate freshets, which seldom exceed 2 or 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkeley Bridge, and 2 feet at Mantua. High water occurs forty minutes later at Mantua than at Paulsboro and the tidal currents are generally sluggish.

For navigation purposes the stream is naturally divided into four sections, viz:

	Miles.
1. From 12-foot contour in Delaware River to phosphate works	0.7
2. Phosphate works to Paulsboro	3.25
3. Paulsboro to Parkers Landing	3.4
4. Parkers Landing to Mantua	4.1

1. 12-foot contour in Delaware River to phosphate works.—This section includes the bar at the mouth, 1,000 feet long, through which a channel 8 feet deep and 66 feet wide was dredged in 1889, and the first 2,600 feet above the mouth proper. This latter portion has an average low-water width of 160 feet, is 225 feet between marsh lines, and has a channel depth varying from 9 to 14.8 feet; on the bar the minimum thalweg depth is 8.6 feet. At the upper end of the section are located the fertilizer works of the I. P. Thomas & Sons Co., the largest industry on the stream.

2. Phosphate works to Paulsboro.—The average low-water width of this section is 100 feet, between banks 200 feet, and the usual channel depth 7 to 8 feet. Navigation is obstructed by several bars, on which the minimum thalweg depth is 6.2 feet, and by numerous sharp bends.

3. Paulsboro to Parkers Landing.—The average low-water width decreases here to 88 feet, between banks to 140 feet, while the average channel depth decreases from 8 feet at Paulsboro to 5 feet at Parkers Landing. There are several shoal places the minimum low-water depth on which is 3.6 feet.

Above Parkers Landing the low-water width narrows to 50 feet, the waterway becomes more crooked, and the channel depths decrease to 1.5 feet at Mantua.

The stream is crossed by 4 bridges: A county road bridge at Paulsboro, with a drawspan of 40 feet; the Delaware River Railroad Bridge at the same place, with a drawspan of 32.9 feet; and at Berkeley by the Swedesboro turnpike bridge without a draw (channel opening 27 feet), and just above the latter structure by the bridge of the West Jersey and Seashore Railroad, also without a draw, the channel span being 27 feet and its height above mean low water about 14.5 feet.

Two plans for the proposed improvement have been considered. The first is the widening and deepening of the present waterway by dredging; the second, the formation of a dredged channel by making cut-offs through the lowland wherever practicable, avoiding shoals and sharp bends. This is the plan desired by the people of Paulsboro, as it shortens the distance between Paulsboro and the mouth nearly 2 miles.

The slopes of the stream, as found by survey, make the construction of the cut-offs practicable and a desirable improvement, especially below Paulsboro, permitting a freer flow of tide and straightening the channel. The cut-offs proposed are six in number, viz: One between the phosphate works and the river, three between the phosphate works and Paulsboro, one above Paulsboro at the Horseshoe Bend, and one 9,000 feet above Berkeley Bridge. They have a total length of 4,595 feet.

Correspondence has been had with the owners of the land through which the principal cut-offs would pass relative to the conditions upon which right of way would be given and with owners of adjacent lands whose riparian rights would be affected by their construction. Below the phosphate works the right of way will be given free, without any limiting conditions. At the Horseshoe Bend the conditions imposed are the construction of ditches, sluices, and meadow banks. Below Paulsboro cash damages are placed at $15,210 for land to be taken, and the further condition imposed that a bank closing the present bends be constructed, the estimated cost of which is $10,000. At the same locality damages to riparian rights are placed at $4,000 and at the Horseshoe at $10,000.

The drawbacks to the plan are the excessive values placed on the rights of way and the riparian rights. The construction of the three cut-offs below Paulsboro will destroy about 12 acres of land and convert 78 acres more into islands. A fair price for this land is $100 per acre, making its total value $9,000, while the value of the riparian rights affected by all the cut-offs and the construction of sluices, ditches, and meadow banks asked for at the Horseshoe would not exceed $2,000 more, making a total of $11,000 for damages to land and riparian rights. In my opinion this is the maximum amount that should be allowed.

It is therefore proposed, provided all rights of way can be secured to the United States and riparian rights quieted for a sum not to exceed $11,000, to form a channel by dredging as follows:

From 12-foot contour in the Delaware River to the phosphate works, 100 feet wide at bottom and 12 feet deep, by making a cut through the marsh; thence to be 80 feet wide at bottom and 8 feet deep to Paulsboro via cut-offs, and thence 60 feet wide at bottom and 7 feet deep to Parkers Landing, with a cut-off at Horseshoe Bend; in all a distance of 7.3 miles by the present waterway, or 4.8 miles via the cut-offs; 9,000 feet above Berkeley, to construct cut-off 350 feet long, 50 feet wide, and 3 feet deep, and remove overhanging trees above Parkers Landing.

In case rights of way can not be secured and riparian rights quieted for the sum of $11,000, it is proposed to construct a similar channel by changing the route between the phosphate works and Parkers Landing to the present course of the stream, widening at the bends.

The limits of the proposed dredging are shown by broken black lines on the accompanying plan.

The first proposed improvement requires the removal of 411,500 cubic yards, place measurement, and, including contingencies and land values, is estimated to cost $112,630. The second requires the removal of 405,500 cubic yards, place measurement, and is estimated to cost $109,000. It is inferred, from the flatness of the watershed, the moderate freshets, and the character of the banks, that the improvement above the mouth would be reasonably permanent. The permanent maintenance of a channel across the bar outside the mouth may require the construction of jetties on both sides, as shown by the broken black lines on the plan; their length is estimated at 1,350 feet, and the estimated cost, including contingencies, at $32,400, making the total cost of the improvement by the first plan $145,030, and by the second, $141,400.

The annual commerce of this creek was estimated in 1894 as follows:

Paulsboro to the mouth.—Six hundred and ninety-five steam and 1,179 sail vessels and barges; 90,450 tons of freight, valued at $1,756,200.

Between Paulsboro and Berkeley.—Seventy-five steam and 175 sail vessels and barges; 13,850 tons of freight, valued at $121,675.

Between Berkeley and Mantua.—Sixty barges; 8,200 tons of freight, valued at $125,000.

Summary.—Two thousand one hundred and eighty-four steam, sailing vessels, and barges; 112,500 tons of freight, valued at $2,002,875.

In my opinion this creek is worthy of improvement, and its improvement is justified by the interests of commerce involved.

The sum of $50,000 could be profitably expended in the first fiscal year.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

H 16.

SURVEY OF ABSECON INLET, NEW JERSEY, WITH A VIEW OF MAINTAINING 10 FEET OF WATER OVER THE BAR.

[Printed in House Doc. No. 252, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 21, 1898.

SIR: I have the honor to submit the accompanying report of January 14, 1898, with map,* by Maj. C. W. Raymond, Corps of Engineers, of the results of a survey of Absecon Inlet (harbor at Atlantic City), New Jersey, with a view of maintaining 10 feet of water over the bar, made to comply with requirements of the river and harbor act of June 3, 1896.

A full description of the physical characteristics of this locality, with plan and estimate for securing 20 feet over the bar, will be found in a report by a Board of Engineers, dated May 31, 1887, upon a survey made in 1886 with a view to the formation of a harbor of refuge (printed in Annual Report Chief of Engineers for 1887, p. 815).

The project for improvement now presented provides for maintaining 10 feet at mean low water over the bar by construction of a stone jetty on the east side of the inlet extending from Brigantine Beach to deep water, estimated to cost, including contingencies, $500,000.

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* Not reprinted. Printed in House Doc. No. 252, Fifty-fifth Congress, second session.

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Major Raymond states that, since this work will require special plant, and should be executed rapidly to insure success, it can be best and most economically done under a continuous contract, the work being, in his opinion, worthy of execution and justified by the needs of the commerce involved.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF MAJ. C. W. RAYMOND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., January 14, 1898.

GENERAL: In compliance with instructions contained in Department letter dated September 5, 1896, I have the honor to submit the following report upon a survey of Absecon Inlet, New Jersey, with a view of maintaining 10 feet of water over the bar, provided for in the river and harbor act of June 3, 1896.

This inlet is the harbor of Atlantic City. It was thoroughly examined and surveyed in 1886, under the direction of a Board of Engineers, with a view to the formation of a harbor of refuge, under a provision of the river and harbor act of August 5, 1886. The report of the Board gives a full description of the physical characteristics of this locality, and contains a project for the construction of jetties to establish a depth of 20 feet over the bar, at an estimated cost of $3,000,000. The report, with accompanying maps, is published in the Annual Report of the Chief of Engineers for 1887, Appendix G, page 815.

By authority of the Secretary of War, and after due advertisement in the public press, a public hearing was held at Atlantic City on December 10, 1897, at which all persons interested in the proposed improvement were invited to express their views. This meeting was largely attended, the mayor and other municipal officers and many of the most intelligent and influential residents of the city being present.

On December 18, 1897, a meeting of citizens was called by the mayor, at which a committee was appointed to gather statistics and data showing the need of the improvement. A full stenographic report of the hearing and the report of the committee, dated December 30, 1897, are appended hereto.

The views and wishes of the people of Atlantic City are fully expressed in the reports referred to, and may be briefly summarized as follows:

The channel of the inlet constantly shifts and shoals through the action of storms and the movement of sand along the coast. Formerly a large number of vessels used this inlet, but in recent years the number has greatly decreased, owing to the difficulties and dangers of navigation. The needs of local commerce require large quantities of lumber, ice, coal, brick, stone, oysters, and other heavy freights to be brought annually to the harbor, and these demands steadily increase with the rapid growth of the city. The difficulty and danger of navigating the inlet compels the payment of excessive freight rates either by land or by water. While an increase in the depth of the channel is considered desirable, the dept of 10 feet at mean low water, which is very little greater than the existing depth, would, it is said, answer all the present purposes of local commerce. The most urgent need is the establishment of the channel in a permanent position with a permanent depth, so that the buoys may always indicate the location of deep water and the conditions for navigation may be surely known. It is claimed that with a channel of entrance thus permanently established the port would be of great value to small vessels as a harbor of refuge.

The present survey was made by Mr. R. G. Pearson, United States surveyor, in July, 1897. A copy of his report, dated November 26, 1897, is appended hereto. The results of the survey are shown on the accompanying map.

By a comparison of the present survey with the survey of 1886, it appears that the principal changes which have taken place are the wearing away of the western end of Brigantine Beach, the low-water line of which has receded to the eastward for a distance of about 1,300 feet; the straightening of the deep-water line of the inlet, the outer channel having moved to the eastward; an increase in the area of the cross section at the gorge, and an increase in the depth of the channel across the bar. In 1886 the area of the cross section at the gorge at mean low water was 24,000 square feet, and the minimum depth over the bar was 7½ feet. The area of the cross section at the gorge is now 28,400 square feet, and the minimum depth across the bar is 9½ feet.

These changes make the conditions somewhat more favorable for the plan of improvement proposed by the Board of 1887 than they were at the time the project was prepared. The only modification required to conform the project to the new conditions are the shortening of the jetties, which need only extend to the 12-foot contour to maintain a depth of 10 feet, and the increase of the distance between them to provide an area of cross section sufficient for the discharge of the entire tidal flow with this smaller depth.

The locations of the jetties as projected by the Board of 1887 are shown on the accompanying map. The axis of the outer channel was given a direction of south 60° east, this being the most southerly direction with which vessels could lay their courses through the outer channel during northeast gales.

The main objections to the construction of these jetties are their great cost and the danger of injury to the neighboring beaches. With reference to the probable action of the jetties upon the beaches, the Board remarks as follows:

> The effect of the construction of the jetties would probably be to cause an accumulation of sand north of the north jetty, and to a limited extent immediately south of the south jetty; but it is not improbable that farther southwest the beach will be cut away in front of Atlantic City, as the supply of sand coming from the northeast gales will be diminished by the jetties.
>
> Another effect of the building of the jetties will be, by interfering with the free flow of the tides, to increase the danger of breaches through Brigantine Beach, which has heretofore been breached several times, but it is now continuous.

To maintain a channel 10 feet deep at mean low water it would probably not be necessary to extend the jetties beyond the contour of 12 feet depth. This shortening of the jetties would greatly diminish the danger of injurious action upon the beaches. Nevertheless, I am of the opinion that there would still be great danger of injurious action by the south jetty. As the result of its construction marked changes in the beach must be expected.

These considerations suggest the inquiry, What would be the results upon the channel and upon the beaches if the south jetty were omitted and the north jetty alone constructed? The position of the axis of the channel varies greatly from year to year, as shown on the map. This is due to the movement of sand in both directions along the coast. The preponderating movement is from the northward, since the most violent storms are from the northeast, and therefore the channel has a tendency to work to the southward. Nevertheless, under favorable circumstances it has occupied a much more northerly position than at present, as, for instance, in 1880. If the north jetty alone were constructed, the channel would be protected from the action of northeast storms and from obstruction by sand coming from the north, and might be expected to move to a position at least as far to the north as that which it occupied in 1880. This is as northerly a position as is desirable, for, with the channel in this position, it could be entered with any wind under which it would be possible for a sailing vessel to pass through the inner channel. No improvement at reasonable cost can make the entrance safe during a northeast gale.

The minimum depth of the existing channel is 9½ feet. Should the channel be protected by the north jetty some deepening is to be expected, but it may be found necessary to direct and assist the action of the currents by dredging.

The construction of this jetty would doubtless cause a large accumulation of sand above it and along the beach of Brigantine Island, but, in my opinion, it will not increase the danger of breaches through Brigantine Beach. It is not probable that it will injure the beach at Atlantic City.

For the reasons above stated, I am of the opinion that the best method for maintaining 10 feet of water over the bar at this inlet is to construct a single jetty on the east side of the inlet, extending from Brigantine Beach to deep water, as shown on the accompanying map. Although this jetty will compel a large quantity of the water of the flood tide now dispersed over its site to flow through the channel, it is designed mainly as a protection from moving sand and storms. It has therefore been located solely with a view to economy of construction, and without regard to its influence as a training wall. Since changes in the bottom may occur, the jetty should be carefully relocated just before the commencement of the work.

The cross section and method of construction proposed by the Board of 1887 has been adopted as a basis for estimate. The jetty is to be formed of rubble stone up to the level of low water, and above that level of heavy stones laid in position. The outer slope is 1 on 2, and the inner slope a little less than 1 on 1. The width on top is 10 feet and the top is 4 feet above the level of mean high water. A settlement of 1 foot is allowed for. Since the site of the work is compact sand, the use of mattresses or brush is not considered desirable. The length of the jetty is 7,422 feet.

ESTIMATE.

The cost of constructing the jetty is estimated as follows:

181,732 tons (2,000 pounds) of stone, at $2.50	$454,330
Contingencies	45,670
Total	500,000

Since this work will require special plant and should be executed rapidly to insure success, it can be best and most economically done under a continuous contract.

The following papers and map are sent herewith:

(1) Copy of report of Mr. R. G. Pearson, United States surveyor, dated November 26, 1897, upon a survey of Absecon Inlet made in July, 1897.

(2) Communication from committee appointed by meeting of citizens of Atlantic City, N. J., dated December 30, 1897, furnishing statistics and data with reference to proposed improvement.

(3) Stenographer's notes of public meeting held at Atlantic City, N. J., on December 10, 1897, to hear public opinion on the proposed improvement.

(4) Map of the survey, showing proposed improvement.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. R. G. PEARSON, SURVEYOR.

PHILADELPHIA, PA., *November 26, 1897.*

MAJOR: I have the honor to submit the following report upon the results of a survey of Absecon Inlet, New Jersey, made during the latter part of the month of July last. The survey extended from the Atlantic City beach to the 18-foot curve of depth in the Atlantic Ocean and from midway between the ocean piers to the Inlet Excursion House. The lines of soundings normal to the beach and 500 feet apart were run whenever the roughness of the water did not entail an error of more than 0.3 foot in reading the lead line. The soundings on the accompanying chart are therefore correct to the nearest half foot.

The datum for the survey was defined by a bench mark on the base of the Absecon light-house, the elevation of which has been given by the United States Coast and Geodetic Survey as 10.61 feet above local mean low water. The tidal range at the inlet is 4.3 feet, or the same as at Lewes, Del. The plane of reference is the same as that used during the survey of November–December, 1886.

The least depth over the bar, just east of the upper ocean pier, is 9 feet over a width of about 1,000 feet and a length of 1,500 feet. From the Excursion House at the inlet the channel has a width of 400 feet between 6-foot curves and a depth of 50 feet at mean low water, gradually diminishing to 20 feet at mean low water at the point opposite the light-house, the width remaining constant. The shoal area east of the channel has a low-water depth of from 1 to 3 feet, and upon it the sea breaks heavily during storms, as well as over the bar at the entrance to the main channel. The bottom of the inlet and the ocean bed, as far as the survey extended, are composed of a firmly compacted white sand. The channel from Atlantic City to Brigantine, however, has on its northern side a bottom of stiff mud.

The tidal currents from the upper ocean pier to the Excursion House set parallel to the beach and during the flood tide are quite swift, being a third stronger than during the ebb. At the Excursion House the current runs with torrential velocity. The movement of the water over the shoal areas in the middle of the inlet is imperceptible. Even when the sea is breaking on the shoals the water is quite clear, indicating but little sand in suspension.

There is but a slight amount of commerce in Absecon Inlet, the movement of boats being principally that of pleasure craft. During the ten days consumed by the survey but one vessel, a schooner with a cargo, was seen entering the inlet. There is a ferry service between the Excursion House and Brigantine Beach, but this is discontinued during the winter season. Coal is sometimes carried to the wharves along Gardners Creek on vessels, and there is also a fish factory there in operation during the fall of each year.

At several places along the beach, but principally at the point opposite the light-house, groins have been formed of brush and stones, secured by a row of pilings, to cause an advance of the beach, thus creating land for property owners holding water frontage. These groins have been so far successful that the point referred to has advanced some 250 feet seaward. A similar groin just east of the point of Brigantine has not accomplished its purpose, however, for it now stands detached from the shore about 150 feet from the high-water line and 1 or 2 feet of water at low tide.

Submitting the above report, together with a map of the locality compiled from the notes of the survey, I remain,

Very respectfully, your obedient servant,

R. G. PEARSON, *Surveyor.*

Maj. C. W. RAYMOND,
Corps of Engineers, U. S. A.

LETTER TRANSMITTING REPORT OF COMMITTEE OF CITIZENS OF ATLANTIC CITY, N. J.

ATLANTIC CITY, N. J., *December 30, 1897.*

DEAR SIR: On December 18 Mr. F. A. Stoy, mayor of Atlantic City, called a meeting of citizens to more practically advance the proposed improvement to Absecon Inlet, resulting in the appointment of a committee to gather statistics and data to clearly show you the great need of this improvement. The result of the work of the committee is herewith handed to you in the attached report.

The report deals with but two interests, that of harbor safety and commercial interests.

E. A. PARKER, *Chairman,*
WARREN SOMERS, *Secretary,*
Committee.

Maj. C. W. RAYMOND,
U. S. Engineer Office.

REPORT OF COMMITTEE OF CITIZENS OF ATLANTIC CITY, N. J.

HARBOR OF SAFETY.

Number of vessels passing Absecon Inlet in one year, between sunrise and sunset, was 8,101, divided as follows: 41 ships, 43 barks, 20 brigs, 4,311 schooners, 2,560 steamers, and 1,126 sloops. This is presumably about one-half of the number that passes during the year.

REPORT FROM LIFE-SAVING STATIONS.

On Absecon Island there are three life-saving stations. From 1886 to 1897, inclusive, there were 139 vessels in distress off the coast of Absecon Island, involving property to the amount of $707,000, from which there was a loss to vessels and cargo of $140,000. This covers about 8 miles of beach only, a very small percentage of the usefulness of the inlet as a harbor of refuge; the nearest harbor of safety being Delaware Breakwater, 40 miles away, the next nearest, Sandy Hook, 100 miles away, a long run in bad weather.

LETTERS FROM COMMERCIAL AND MARITIME EXCHANGES.

We herewith attach letters received from the various commercial and maritime exchanges, relative to an inquiry to them touching the subject in hand. The very limited time to file our report prevents the possibility of showing their action in the matter, though their prompt replies are convincing that they are interested.

COMMERCE.

Data relative to the growth of the city.

Population.

1871	1,160
1881	6,125
1891	13,999
1895	18,329
1897	*23,000

Visiting population, in height of season, reaches from 150,000 to 175,000.
Property valuation estimated at between $40,000,000 and $50,000,000.

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* Estimated population from registered list.

SHIPPING.

Pilot Yates, the only pilot on the island, reports 1,395 vessels entering Absecon Inlet between the years 1886 and 1897, inclusive, showing a tonnage of 303,000 tons. This is about 75 per cent of the total number and tonnage. Seventeen hundred and fifty vessels, with a total tonnage of 400,000 tons, is about the number of vessels and tonnage that entered Absecon Inlet during the years from 1886 to 1897, inclusive.

The following statement shows number of vessels entering the inlet each year, as noted by Pilot Yates:

Year.	No. of vessels.	Average tonnage.	Year.	No. of vessels.	Average tonnage.
		Tons.			*Tons.*
1886	136	300	1892	80	*a* 150
1887	162	250	1893	55	*a* 100
1888	139	250	1894	84	250
1889	148	250	1895	111	250
1890	101	*a* 200	1896	151	250
1891	78	200	1897	101	100

a Bad bar.

In 1886, with a population of about one-third of present population, the number of vessels entering inlet was 136; tonnage, 40,800; 1897, number of vessels entering, 101; tonnage, 10,100. Had the tonnage increased in same rate with the growth of population and commerce of the city it would have been between 125,000 and 150,000 tons, the bar across the mouth of the inlet being the sole cause of the decline.

COMPARISON OF FREIGHT RATES.

We herewith show a comparison of water and rail freight rates. The water rates, in their full value, we are unable to take advantage of solely from the reason that the bar across the mouth of the inlet prevents entrance of vessels drawing moderate depths of water.

Anthracite coal.—All-rail rate from mines to Atlantic City, $2.25 per ton. Water rate, vessels drawing 8 to 9 feet, from Port Richmond to Atlantic City, 60 to 75 cents per ton; vessels drawing 14 feet, from Port Richmond to Atlantic City, 50 to 65 cents per ton. Rail rate from mines to Port Richmond, $1.40 per ton.

Ice.—Rate from Maine to Atlantic City, vessels drawing about 8 feet of water, about 300 tons burden, $1 to $1.05 per ton; vessels drawing 14 feet of water, about 800 tons burden, 50 to 60 cents per ton.

Lumber.—Rate from Brunswick, Ga., to Atlantic City, in vessels drawing 8 feet of water, $6.50 per thousand feet; vessels drawing 14 feet of water, $4.50 per thousand feet. Rate from Norfolk, Va., small craft, drawing 8 feet of water, $2.50 per thousand feet; rate from Norfolk, Va., large craft, drawing 14 feet of water, $1.75 per thousand feet.

Stone and brick.—Rate from Philadelphia via rail $1 per ton; rate from Philadelphia via water, small craft, drawing 8 feet of water, 60 to 75 cents per ton; craft of 700 to 1,000 tons, drawing about 14 feet of water, 50 to 65 cents per ton.

We herewith attach letter from one firm as an instance to show the difficulty contended with in handling even small craft. We refer to letter from Knickerbocker Ice Company, attached.

It is all important to the growth of Atlantic City to nourish its commerce by giving it the full benefit of its possibilities of transportation by water. At present there are but two railroads entering the city, with no competition between them on rates. The rate for the 60 miles haul from Philadelphia is equal to a rate charged to competitive points for a haul of 200 miles. The freight rates of the two railroads entering Atlantic City on freight shipped to Atlantic City is about $500,000 annually.

The loss on freight paid during the time between the years 1886 and 1897, inclusive, through the necessity of using small vessels to bring in the 400,000 tons of merchandise mentioned, against using large vessels to carry the same merchandise, shows from the most careful figuring to be about $1 per ton, or a total loss of $400,000. This represents but a fraction of the actual total loss due to the lack of water facilities. The great value of the deepening of the inlet is very marked, insomuch that it will adjust rail rates, largely attract shipping interests, secure passenger traffic via water from New York; in fact, it is simply of incalculable value to the interests of Atlantic City, and as a harbor of safety of great value to the nation.

YACHTING INTERESTS.

The yachting interest is an important one to Atlantic City, but yachts of the large type can not enter the inlet, due to shallowness of water.

IMPORTANT PROBLEM.

The surplus population of this city is very large during six months of the year. A very serious problem confronts us insomuch as how to employ them under present conditions. Freight advantages due to full waterway advantages will secure manufacturing interests and thus solve a most important problem.

WARREN SOMERS,
S. P. MORRIS,
WM. N. JOHNSON,
JOHN F. TURNER,
JESSE YATES,
E. A. PARKER,
GEORGE H. LONG,
Committee.

LETTER OF THE SECRETARY OF THE BALTIMORE (MD.) CHAMBER OF COMMERCE.

BALTIMORE CHAMBER OF COMMERCE,
OFFICE OF THE SECRETARY,
Baltimore, December 27, 1897.

DEAR SIR: Your communication, under date 20th instant, asking cooperation regarding the proposed improvement by the Government of the harbor of Atlantic City is before me, and the same has been duly referred to the proper official of this organization, and from whom you may hear direct later.

Very respectfully,
WM. F. WHEATLEY,
Secretary.

Mr. WARREN SOMERS,
Secretary Citizens' Meeting, Atlantic City, N. J.

LETTER OF THE SUPERINTENDENT OF THE MARITIME ASSOCIATION OF THE PORT OF NEW YORK, N. Y.

THE MARITIME ASSOCIATION OF THE PORT OF NEW YORK,
New York, December 22, 1897.

DEAR SIR: I take pleasure in acknowledging the receipt of your favor of 20th instant, stating that the Government have under consideration a proposed improvement to the harbor at your place, which if carried out will increase the depth of water on the bar, besides straightening the channel, and will establish a harbor of refuge there.

It has been referred to the appropriate committee, who will give the matter careful consideration, and, pending their action in the matter, I remain, with the compliments of the season,

Very truly, yours,
F. W. HOUGHTON,
Superintendent.

WARREN SOMERS, Esq.,
Secretary Citizens' Committee, Atlantic City, N. J.

LETTER OF THE SECRETARY OF THE PHILADELPHIA (PA.) MARITIME EXCHANGE.

THE PHILADELPHIA MARITIME EXCHANGE,
Philadelphia, December 22, 1897.

SIR: I have to acknowledge receipt of your favor of 20th instant, relative to a proposed improvement to the harbor of your city, and your desire for some action by our board in connection therewith.

In reply I beg to inform you that our board of directors will meet on Monday the 27th instant, and I shall take pleasure at that time in presenting your letter for consideration.

Yours, faithfully,
E. R. SHARWOOD,
Secretary.

WARREN SOMERS, Esq.,
Secretary Citizens' Committee, Atlantic City, N. J.

LETTER OF THE SUPERINTENDENT OF THE KNICKERBOCKER ICE COMPANY.

KNICKERBOCKER ICE COMPANY,
Atlantic City, December 29, 1897.

DEAR SIR: The Knickerbocker Ice Company ship from the Kennebec district about 15,000 tons of ice between the months of April and October.

It is with great difficulty we enter the inlet, owing to the shallowness of the water. We are obliged to have our vessels lay off the bar at times for nearly a week before getting in. Many times we have to send them elsewhere, not being able to get in. In two cases the vessels got on the bar; one was a total loss, both cargo and vessel; the other, the cargo was thrown overboard and the vessel damaged.

I believe the commercial interest would be greatly increased by deepening the inlet.

Yours truly,

WM. N. JOHNSON,
Superintendent.

WARREN SOMERS,
Secretary Committee Inlet and Harbor Improvement.

LETTER OF CAPTAINS EZRA CONOVER AND E. WATSON.

ATLANTIC CITY, N. J., *December 17, 1897.*

DEAR SIR: At the hearing for the improvement of the harbor at Atlantic City, held recently, the oyster industry seems to have been omitted from consideration. We beg to state, therefore, that a conservative estimate of the commercial importance of this trade would show that 40,000 to 50,000 bushels of oysters are received from Southern beds annually over Absecon Inlet Bar. Any improvement of the inlet channel would facilitate this traffic and increase the safety of the vessels engaged in it.

Respectfully submitted.

CAPT. EZRA CONOVER.
CAPT. E. WATSON.

Major RAYMOND,
U. S. Engineers, Philadelphia, Pa.
(Through committee.)

LETTER OF THE SOMERS LUMBER COMPANY.

SOMERS LUMBER CO.,
Atlantic City, N. J., December 31, 1897.

SIR: We are engaged in the lumber business in this city, receiving annually about 30,000 tons of material, most of which comes from points where water freights should be used to handle goods to best advantage. Of this amount we receive 3,000 to 5,000 tons by water, the balance by rail. We pay an excess freight on the amount we now bring by water of from $3,000 to $4,000 annually over the cost of carrying the same amount of goods in larger vessels, and twice as much additional loss by reason of using rail instead of water transportation. We are sometimes unable to obtain vessels at any cost.

We have to-day two Southern cargoes which we have been offering in vain to vessels for the past two months, offering vainly $7 freight, while vessels are easily obtained at $4 to $4.50 from same point (Brunswick, Ga.) to Philadelphia.

Yours respectfully,

SOMERS LUMBER CO.
WARREN SOMERS,
Treasurer and Manager.

Maj. C. W. RAYMOND.

LETTER OF MR. RICHARD M'ALLISTER.

ATLANTIC CITY, N. J., *December 29, 1897.*

MY DEAR SIR: In reference to the benefit I would derive from my coal business provided the waters of Absecon Inlet would permit the passage of large vessels, I beg to inform you that I was about to erect coal wharves and have my coal come via tide water, but on having a meeting with the pilot, Captain Yates, I was informed that it would be impossible to handle coal in this way unless vessels of small tonnage were used, on account of the shallowness of the water in the inlet channel, so in this case I had to dispense with my intentions. My output of coal is about 15,000 tons per year, and I would save about 50 cents per ton in the way of freight if the inlet was put in condition to admit the passage of large vessels, say 1,000 tons or more.

Hoping that for the benefit of a harbor of refuge to admit the pleasuring yachts, also the benefit it would be to commerce, I sincerely hope that your organization will be instrumental in having the plan to deepen the waters of Absecon Inlet adopted.

Very respectfully,

RICHARD MCALLISTER.

WARREN SOMERS, Esq.

MINUTES OF PUBLIC HEARING.

[Held at Atlantic City, N. J., December 10, 1897.]

On December 10, 1897, a public meeting was held in Odd Fellows' Hall, Atlantic City, N. J., for the purpose of hearing public opinion on a proposed depth of 10 feet of water over Absecon Bar.

Present: Major Raymond, Corps of Engineers, United States Army; Thomas M. Farrell, assistant engineer, United States engineer office, et al.

The meeting was opened at 10.45 a. m. by Maj. C. W. Raymond, as follows:

Maj. C. W. RAYMOND. In the river and harbor act of June 3, 1896, there is a provision requiring the Secretary of War to have a survey made of Absecon Inlet, with a view of maintaining 10 feet of water over the bar. This survey has been made under my direction by order of the Secretary of War, and I am required to make a report on this inlet and submit a project to the Secretary of War, to be sent by him to Congress, with a view of maintaining 10 feet of water over the bar in that inlet. In order that the Secretary may be fully informed of the necessities of this inlet, and of the benefit to navigation and commerce which such an improvement would be, I thought it desirable to have a public hearing at Atlantic City in order to give everyone that is interested in the improvement an opportunity to state his views in connection with it, and upon my recommendation the Secretary of War authorized the holding of this hearing to-day.

The survey of the inlet has been completed, and it now only remains for me to make a project to carry out the intentions of the law, and to submit with that project all the information that I can obtain with respect to the needs of the port and of the benefits which would be derived from such an improvement, in order that Congress may determine whether the necessary expenditure is justified in this case.

About ten years ago a Board of Engineers made a report on this inlet. They made a very careful study of it, and submitted a project for the improvement of the inlet so as to provide for a depth of 20 feet of water over the bar, and to make a harbor of refuge at that place. They estimated that the cost of this improvement would be $3,000,000; and no further action was taken by Congress, because, I presume, they considered the commercial interests of the inlet at that time did not justify the expenditure of so large a sum. Of course, a project which contemplated a very much less depth of water would cost very much less money. I can not say what the cost of the improvement of the inlet would be at present, because the study of it is not yet completed; indeed, it is only just commenced.

The information which I hope to get here to-day with respect to the needs of commerce at this place will be of great value to the Secretary of War and Congress in determining what is proper for the Government to do. Therefore I shall be glad to hear an expression of the views of anyone here to-day. I shall ask you to be kind enough to speak and state your name as distinctly as possible, so that the stenographer may make a record of it for the minutes of the meeting, and state also if you represent any particular interest at Atlantic City, and also state what interest you represent.

I am very much pleased to see that the mayor of the city is here, and a great many other prominent gentlemen connected with the city, and I suggest, out of courtesy to him, that he be allowed to open the meeting by any remarks which he chooses to make; after that I shall be glad to hear in succession from any and all who are present.

FRANKLIN P. STOY (mayor, Atlantic City). Major Raymond, I don't know that I have any remarks to offer just at this time. I will assure you, however, that the people of Atlantic City and Atlantic County appreciate the efforts you have made endeavoring to have passed what I believe should be carried out.

I would suggest to the people here to-day that would like to speak on this subject to be as pointed and as brief as necessary to allow each and everyone who cares to speak sufficient time to express themselves thoroughly, and I think that Major Raymond will appreciate it if you will occupy no more time than ten or fifteen minutes.

I see that there are several persons in the room, Major Raymond, that you would like to hear from, and if they do not speak it will be our occasion to call on them; and I hope now that you will hear from some of our most prominent people.

Capt. THOMAS C. FRENCH. I may as well speak first as last. The first time I saw Absecon Inlet I came in on an oyster boat, and there was then about 6 fathoms of water over the bar, and I think the channel was considered as south and northwest; that was in 1840. Since then there have been several schooners cast away on it, and the sand has gathered about them and shoaled the channel, and now most of the time there is only about 5 feet of water. I think if jetties built of stone and brush were run out to the channel it would help matters, and there are men here who would do this if you would give them the land this would make; the channels then would run into one. I went into this subject several years ago, and I believe the improvement can be made for a great deal less than $3,000,000.

Gen. ELIAS WRIGHT. I have no knowledge of navigation, but I have some of running water and tides. My belief is that Captain French's idea is a good one, though it may not be in practice; namely, that some piles put down would make a channel sufficient to restore this harbor to its old-time prestige—that of a harbor of refuge. I remember having seen and counted 59 vessels in this inlet years ago in case of a storm. The vessels would make this place a harbor of refuge, and I think it ought to be reasonably easy to restore it to that condition again. Still, engineers who have given the matter a study ought to know more about it than I do. I have heard some objection to building jetties, arising from people interested in bathing. I have heard them say that possibly the bathing would be injured. All I have to say to that is that I know of but one place for Absecon Inlet; there are many places along the coast for bathing. I think that that objection is not sound.

Judge JOSEPH THOMPSON. I am not an engineer, Major Raymond, or a skilled captain. I don't know that lawyers and judges can give very much light on this subject. However, I think that Atlantic City is to be congratulated in having such a representative set of men present, people who are interested as citizens, landowners, and as shippers. We have here the representative of the Somers Lumber Company, that brings a large number of cargoes of lumber to this port, and would bring more if there was more water. The same might be said of the Knickerbocker Ice Company. The same might be said of several other firms shipping large quantities of brick. Now, all these men have complained for years that there was not a sufficient depth of water over the bar, and, further, that there was shifting and shoaling of the bar constantly, and in that Atlantic City is interested. I think that I heard you say in opening this meeting that some ten years ago you had taken up this question, and had given it some consideration. I think you have discovered that since that time Atlantic City has grown greatly in importance; that it is assuming a position where it has a right to ask, a right to demand that something be done to improve the waters of the inlet. It is hardly necessary to refer to the importance of a harbor of refuge between Sandy Hook and the Delaware Breakwater. Congressman Gardner, speaking in Congress a few weeks ago, said that he remembered when he was a boy coming over from the mainland after such a storm as we had a few weeks ago, and counting 104 sail of vessels in this inlet. They were vessels of all sizes, some schooners and some square-riggers. At that time I think there was at least 15 feet of water on the bar. I refer to this to show how important it would be to have a harbor where vessels could come in quickly in case of a storm between Sandy Hook and Cape May. Of course, for large steamships we do not expect it, but just for vessels of moderate draft. I think you can get a good deal of information on this question from the representatives of the Knickerbocker Ice Company, the Somers Lumber Company, and others present. These gentlemen are here, and could probably give you data that would be of weight in this matter. I know that everyone here is interested deeply in this subject. We are not only willing, but we are anxious, to help you make a report on this matter to the Secretary of War.

Major RAYMOND. If there are any who at any time within the next month desire to make any statement in writing and submit it to me at Philadelphia, I shall be very glad to receive it. My object is to get all the information I possibly can on the subject from the people of Atlantic City. There may be some commercial statistics which the gentlemen present may not be prepared to submit to-day, but which could be submitted more readily and in better form if they were sent to me in writing at Philadelphia. So you are all invited to write anything on the subject to me and I shall be glad to embody it in my report and submit it to the Secretary of War for his consideration.

Mr. WARREN SOMERS (Somers Lumber Company). We have been engaged in the lumber business here for many years. We are compelled to use small, light-draft vessels to carry our cargoes, when if we had a proper depth of water over the bar we could use vessels of greater depth and tonnage. When we go to the ship brokers and ask for a vessel to carry a cargo of lumber, and they know that it is intended to go over Absecon Bar, we have to pay excessive rates of freight, for they know the risk that is to be run, and of course the prices are higher than they would otherwise be; not only that, we have to insure the cargoes, which we would not have to do if we were reasonably sure that the vessels would not go on the bar and break in two. We pay higher rates of freight than are paid at the corresponding time in Philadelphia. The lumber business of the port amounts to about $200,000 annually, and if freights were lower it would mean a great deal more business. We are at a disadvantage, too, on account of the crookedness of the channel. Vessels come here with cargoes and have to wait for a favorable wind to get in, and often when waiting a storm comes up and they have to run down the coast to the breakwater, and then when they try to get in here they do not know but that they will strike on the bar. I speak from experience, and there are other people in the same business here who will tell you the same things that I have said.

Major RAYMOND. The information I want to get here at this meeting is such as this gentleman has given, bearing on the question as to what the Government would be justified in doing in the way of improving the inlet. It is information of this kind that will impress the River and Harbor Committees of Congress when the question comes up as to what money they shall appropriate for the different parts of the country if they find the improvements are very much in excess of what it is possible to grant. They will want to know what amount of benefit could actually be derived from any improvement which they will decide to make. No report from the War Department can go to Congress with any effect unless there is behind it just such information as Mr. Somers has kindly given us.

Mr. SOMERS. My statement is from only one of a number engaged in business here who could show by figures that a larger business could be done if there was a proper depth of water constantly on the bar.

Major RAYMOND. That suggests a line of inquiry to me, and I hope the lumber interests of Atlantic City will assist me by sending me statistics on this point, and so should all the other important commercial interests.

Mayor STOY. I would like to introduce another lumber merchant, Councilman George Long.

Mr. GEORGE LONG (councilman). I have had considerable experience in the lumber business, having been connected with it for about seven or eight years. As Mr. Somers has stated, we have had considerable trouble getting vessels over the bar with cargoes. When they come here we do not know but that they will strike on the bar. There is one case that I remember, where a vessel started from Norfolk for Atlantic City with lumber, and when she came here she had to wait for a favorable wind to get in, and when she tried to come in she was wrecked on the bar. If there was an increased depth of water on the bar vessels of larger draft could bring larger cargoes, and that would make a great difference in prices to Atlantic people.

Mayor STOY. State to Major Raymond the condition of things at the time the lumber came here for the new board walk.

Mr. LONG. When the lumber came here for the board walk the vessels bringing it were compelled to lie off the bar, as their draft would not allow them to come in; and at last the lumber had to be thrown overboard about a mile from shore, and then it was towed to the beach until the vessels were unloaded enough to allow them to come in, which necessitated a great additional cost. If we had from 12 to 15 feet of water these vessels could have come in at two-thirds the amount of cost of unloading, besides hastening the delivery.

Major RAYMOND. This act of Congress provides for a depth of only 10 feet over the bar. The law prohibits a report from an engineer officer except such a report as is absolutely required by it. The law prohibits me from making any other report than on a depth of 10 feet. I would like to ask Mr. Long if a depth of 10 feet would be of any advantage to the lumber business if this depth was properly placed and properly maintained?

Mr. LONG. We could then bring vessels here carrying from 125,000 to 150,000 feet of pine with a mean draft of 10 feet. You mean low water, I imagine?

Major RAYMOND. I would say this: While the law provides for the maintenance of a channel 10 feet deep we would be justified in making a channel 12 feet deep, so as to be sure of maintaining a channel 10 feet deep. The law does not provide for a channel only 10 feet deep, but for the maintenance of a channel 10 feet deep. I am prohibited, however, from submitting a report on any greater depth. I would like to ask Mr. Long if such a depth would be desirable?

Mr. LONG. At what?

Major RAYMOND. Mean low water.

Mr. LONG. It would answer every purpose for the present line of business. It would allow from 14 to 15 feet of water to come in on at high water.

Major RAYMOND. I do not hesitate to say that in maintaining a channel 10 feet deep over the bar the channel should be made at least 2 feet deeper, because you can always provide for a little temporary shoaling; moreover, there are extreme low tides, causing low water, and therefore to get a 10-foot channel you need to have at least a 12-foot channel.

Mr. JOHNSON (Knickerbocker Ice Company). I am interested in the shipment of ice here, and during the time that I have lived in Atlantic City the increase of population has been wonderful. We are obliged to carry a large stock of ice from May to September, some of which we bring here on the cars, but the most of it we bring in in 45 to 50 small vessels of light draft. The great difficulty with us is, that we can not get vessels of large tonnage to carry our cargoes on account of the liability to loss of the cargo and damage to the boat on the bar. In several instances we have had to throw the cargoes of ice overboard in order to save the boat, and in one case we lost a vessel from this cause. As a result, the freight rates are extortionate, and this raises the price of ice to the consumer. We are obliged to ask the shippers on the Kennebec to charter only vessels of light draft, and we are not able to get sufficient boats to carry ice. Because of this, we have been compelled to ship by train at a high rate of freight. My opinion is that if you deepen the draft of water commercial interests would be greatly increased.

Mayor STOY. I will now introduce a gentleman representing the yachting interest of Atlantic City, Capt. E. A. Parker.

Capt. E. A. PARKER. I am interested in having the inlet deepened. They tell you that at present there is 6 feet of water on the bar, but it is not there; but even that depth is not enough at mean low water. You can not take a boat with a greater depth than 4 feet 8 inches over the bar, and you are very fortunate if you can get out with that.

Another thing, the buoys are not in range of the channel, and have not been for the last five years. They just put them out there, and you never can tell from them where the channel is. People have come to me and said that the buoys were not in the right place, and I have gone out and found that they did not show where the channel was at all; they were away out of the channel.

If you deepen the inlet there would be a great increase in commerce; yachting people would come here; people from New York, Baltimore, and Boston would come here in their yachts if they were sure that they would not run aground and go to pieces. If we had a safe entrance to our harbor, New York yacht clubs and the clubs of Philadelphia would come here. These are the people that have plenty of money to spend, but they know there is no use in coming here with yachts drawing 6½ feet of water. There was the case of the yacht *Columbia* last summer waiting to get in, and at last, in a blow, she had to run for the breakwater at Cape May. In this way a great deal of money is lost to Atlantic City people.

As regards making this port a harbor of refuge, on the whole I think it would be a great benefit. For boats going toward Sandy Hook and boats coming from Sandy Hook, if they are surprised in a squall there is no port between Sandy Hook and Cape May Breakwater. Vessels that are caught in the frequent storms that sweep along our coast are sometimes lost before they can reach Sandy Hook or the Delaware Breakwater. If they are caught in a squall between Sandy Hook and the breakwater, they have to run back often to the breakwater—a matter of 30 or 40 miles, maybe—whereas if we had 14 or 15 feet of water on the bar they could run in here, saving all the distance between Absecon Inlet and Cape Henlopen, which would be a great advantage. There need not be any trouble to make this inlet have anywhere from 12 to 15 feet of water at mean low water. As regards getting such a depth, I can see no difficulty about it. I was down at Charleston a few years ago and saw the work that had been done down there by jetties; the same thing could be done here. If there were four jetties built—two on the Brigantine side of the channel and two on the Atlantic City side—they would cause the current now sweeping in six or seven channels to take but one course, and the channel could be made to deepen itself without much dredging. The natural result would be the filling in of sand about the jetties, and this would create a channel of sufficient depth to permit nearly any size vessel to come in. I studied this out some little time ago and have made out several plans on the cheapest way of doing this.

Major RAYMOND. I shall be very glad to have you send them to me at Philadelphia.

Mayor STOY. I shall now introduce, Major Raymond, another representative of the lumber interest, Mr. E. R. Donnelly.

Mr. E. R. DONNELLY. I can not say anything further than what has been said in regard to the lumber interest by Mr. Somers and Mr. Long; I can not add anything further to it.

Mr. W. H. BARTLETT (merchant). I can say that the deepening of the inlet, as far as commercial interests are concerned, would be a very good thing. The fact of being able to get a vessel in here would make a difference of a dollar a ton on freight; the rate is very high now. In respect to the benefits to be derived I think they are unquestionable and everyone is interested in them, and anything we can do to bring about this improvement ought to be done. I don't know that I have anything further to say, unless that I hope the movement will be successful.

Mr. I. G. ADAMS. Atlantic City, as has been said, is a city of a wonderful growth. The mercantile interest is increasing, the traffic on the railroads is increasing, and they are bringing to this place their trains from the west, and so the business of the place is increasing every day, but the entrance to the harbor has become worse every year. Regarding the inlet, it is too shoal to admit vessels for a harbor of refuge, and the bar ought to be deepened to allow vessels to enter. If jetties were built out, it would deepen the channel; this can be accomplished and at the same time protect the beach. We are all deeply interested in what the Government is going to do for us.

Mayor STOY. Major Raymond, I will now introduce a gentleman who represents the brick interest, Mr. D. B. Ingersoll.

Mr. D. B. INGERSOLL. What has been said, Major Raymond, interests me, for I have to use a number of vessels to carry my brick. They are all of light draft, and on account of this bar I have to take vessels I would not otherwise have. If this improvement was made it would benefit me, for I could then get vessels drawing from 10 to 12 feet of water, and thus my brick would be brought in cheaper. We are forced to take vessels that are not seaworthy, and we have to have them insured, for we are not sure that they can get in. I had several vessels come here with brick that could not get in, and they gave me a great deal of worriment until they were unloaded. My freight amounts on these vessels to about from $4,000 to $5,000 per year; on larger vessels it would be a great deal less. I think if the inlet was deepened it would benefit outsiders as well as myself.

Mayor STOY. Major Raymond, I think you will be pleased to hear from Councilman Edward S. Lee now.

Mr. EDWARD S. LEE. Mr. Chairman, I agree with what Mr. Ingersoll has said about getting boats in. When we go to charter small schooners to come here we find it very hard to get them, for they know that when they get here they are liable to lie off here a week before they can get in over the bar. Owing to the crookedness, and the changing of the channel, it is very difficult, too, to bring boats in when the wind and tide is not favorable, and even when they are both favorable. Plenty of boats come here and find that they can not get in because they draw over 7 feet. We find that a great setback when we go to charter boats from the commission men; we find they are all afraid of this harbor, because there is no certainty as to where the channel is, it changes so fast. My freight amounts to $6,200 per year in the way of vessels, and I ship over 3,000,000 of brick. I would like to ask Major Raymond what effect the improvement of the channel would have on the beach front.

Major RAYMOND. I have not made up my mind yet, and I could not give you any information on it at present; it is to be carefully studied.

Mr. EDWARD S. LEE. Is it not a matter of record in your department, and has it not been said by engineers, and probably by yourself, that to create a sufficient channel there would possibly destroy the beach at Pacific avenue for bathing purposes?

Major RAYMOND. That statement was probably made by the Board of 1887, of which I was not a member. It was a Board of very distinguished officers; they, I think, made some remark with reference to the effect of the jetties upon the beach at Pacific avenue. Of course, the jetties planned at that time would not necessarily have to be the jetties which we would adopt now. The jetties planned for that project, which were for 20 feet of water, would be very much longer, and might perhaps affect the beach front more than those planned for a depth of 10 or 12 feet of water over the bar.

Mr. EDWARD S. LEE. In any event, would it not be necessary for the present owners of the beach front, in order to retain their holdings, to put in a system of jetties in conjunction with the Government?

Major RAYMOND. I am not authorized to give any engineer opinion in public, and so you will have to excuse me. The Secretary of War only authorizes me to hold a hearing, and if I have to express an opinion on the subject it will have to go to him first. I hope, therefore, you will excuse me from expressing any opinion on the question. Another reason is that I have not yet completed the study of the question; but the possible effect of any structure which may be required to deepen the channel will be studied as to how it will affect the beach front. I am perfectly aware of the importance of the beach to Atlantic City, and I should be very careful about recommending any structure which would do the beach injury. That will be looked into very carefully.

Mr. EDWARD S. LEE. I wish to say that while the deepening of the channel over the bar is a very important thing, yet the beach is more important.

Major RAYMOND. I can very well understand that. I will ask you one question, which occurred to me while you have been speaking. Is the crookedness of the channel and its variability more trouble to navigation at this place than the lack of depth?

Mr. EDWARD S. LEE. It has been the past few years an element in the difficulty. I have had vessels lie off the bar waiting for a favorable wind to get into the channel. Some of them have kept to the channel and got over the bar; and I have had vessels get on the bar, and then we would have to throw the brick overboard. There is no knowing what will happen when you try to get over the bar, and no matter how short the run we always have our brick insured.

Major RAYMOND. There are two ways in which an improvement of this kind could benefit navigation. One is by giving an increased depth, the benefit of which is apparent. The other is by fixing the channel in its place and maintaining it there. I was anxious to know which of these two defects in the channel was most troublesome to navigation—lack of depth or lack of stability. I suppose they are both elements in the problem, and it would be pretty hard to say which is the most important.

Mayor STOY. Major Raymond, I will now introduce the pilot of the port, Capt. Jesse Yates.

JESSE YATES (pilot). I have been in the pilot business all my life. During the last ten years shipping has fallen off over one-half, mainly on account of the shoalness of the bar. The inlet has been getting shoaler since 1886; then it was good for 11 feet at high water. Since then it has been as shoal as 7 feet at high water, and the channel is very narrow after the bar is crossed. One place in the channel is only about 200 feet wide to get up in the harbor. I have gone out to vessels that have signaled for a pilot, and when they told me what they were drawing I have had to send them away to the Delaware Breakwater, for they could not get in here for shelter. There was the case of the schooner *Columbia* here this summer; she waited outside, waiting for the right wind to take her in, and a northeaster came up and she lost all her headgear, and was likely to go on the beach. There have been about twenty-five to forty vessels this year that I have had to send away, because their draft would not allow them to come over the bar. I think the deepening of the bar would be a great benefit to yachting. Frequently yachts come here, and when the owners, on inquiry, find out about the bar, they go away again; that happens often. The shipping this year has fallen off about one-half over last year. There was about 300,000 tonnage came here last year, and only about 150,000 tonnage this year. There have been about 12,000,000 brick shipped here this year that have caused lots of trouble; they are shipped in vessels of an average draft of 6 or 7 feet. If they were shipped in larger boats freight would be much cheaper, for one large vessel could bring in four cargoes of the smaller boats; the same way with lumber.

Major RAYMOND. Do you think that the bar is constantly changing?

JESSE YATES. It changes. I have been taking boats in and they have come to me and said that the channel did not look right, when I would go out to examine it and would find that it had changed completely from where it was last time I saw it. It shifts from 7 to 9 feet. The late storm deepened the channel on the bar to 9½ feet.

The light-house people have got buoys there, but they don't mark the channel, and the other day when I told them that one of the buoys—a bell buoy—was out of order, when the inspector came down the clapper of the bell had got loose again and he got mad because there was nothing wrong. They don't want to bring their steamers here to set the buoys and have to bring them back again to set them again because the channel changes so often.

Major RAYMOND. I think it is a question with the light-house people of a permanent channel. When they first set the buoys they indicate the channel, but they never indicate the channel always, for the channel shifts and the buoys remain stationary. Of course, if there was a permanent channel they would have no trouble with the buoys.

JESSE YATES. Regarding the beach front, I don't think if you would build a jetty to deepen the bar that it would injure it. I think it would improve it. The jetties built by the Government years ago to protect the light-house have made a beach for 600 yards out from the light-house. I think the jetty would protect the beach.

I. G. ADAMS. I think the jetties would protect the beach, as it would save them from the effects of the northeast storms; and if jetties are necessary to make a permanent channel, the jetties would be a protection to the beach instead of an injury.

Mayor STOY. I will now introduce a gentleman prominent in Atlantic City and Atlantic County affairs, Mr. Levi C. Albertson, ex-postmaster.

Mr. LEVI C. ALBERTSON. I am personally interested in anything that interests the mercantile and commercial interests that are represented here to-day, who would be most benefited by this improvement of our channel. It is a pleasure to see so many persons of this city of rapid growth interested in this improvement, which would help to extend the blessings of civilization to this place and improve the scope of our business, and I think the request for better waterways in this part of the country is reasonable. Congress should give it careful consideration, and an appropriation should be granted for the improvement of our harbor.

As for a harbor of refuge, what better place is there for one between Sandy Hook and Cape Henlopen when vessels get caught in the frequent storms that sweep along our coast? As for the Delaware Breakwater, I recollect with some distinctness having had some experience with it. You know as well as I do that for small vessels it is not any better than a small corner in Hades; I have been there, and I have wished that I was somewhere else.

There is a large amount of commerce conducted in the small inlets and thoroughfares between Cape May and Sandy Hook, and it is growing as the seaside resorts increase in number and population. The improvement of the channel over the bar, to make 10 feet of water at mean low water, means that these small coasting vessels will have a port for a harbor of refuge in case of storms, for in almost all these inlets they must have favorable wind and tide to get in, and they can not always get there just at the right time; and if caught in a storm they would not have to go back to Sandy Hook or Cape May.

This is a representative Atlantic City audience, and it has one feature, and that feature extends to all the people of Atlantic City—they are all interested in and desire the improvement of the inlet and channel. As for how to do it, that may be safely left to the intelligence of the Engineer Department, as represented by Major Raymond.

JOHN F. HALL. I do not think the importance of Atlantic City is recognized as it should be, when you take into consideration its size and importance, its peculiar location, and what it is to be ten years hence. We stand here now as the only seaside resort with a permanent population exceeding 20,000 people. The railroads have brought these people here almost exclusively, and they are double-tracking their lines to accommodate the 100,000 people that come here to live for the summer. When you consider the extent of her population in summer and winter you will have a better appreciation of the fact that the commercial interests of Atlantic City should be facilitated instead of hindered—instead of being crippled by a lack of water. Atlantic City, as has been said, is peculiar, because of its peculiar location on the centerly portion of the New Jersey coast, far away from any fresh body of water mingling with the salt water of the ocean. It is unlike Asbury Park or Long Branch because there is no large river like the Hudson emptying its icy waters along its shore, and as is the case also at Cape May, which receives the cold water of the Delaware. We are favorably situated in this respect, and as a health resort, in its climate and in its location, and as a bathing resort this city is far and away beyond any other seaside resort; and when you look at the statistics of our city, at the population and its growth during the last twenty years, then you have a better basis on which to estimate the importance of this improvement.

As Mr. Parker has said, there are hundreds of yachts—pleasure yachts—representing hundreds of thousands of dollars, that would come here if they could, and they are entitled to some consideration. They, too, want an appropriation for the improvement of this channel. It seems to me in view of all these facts—the extensions of the railroads and of the local enterprises which are giving this town, with a population from 20,000 to 100,000, a commercial importance—that it should have an appropriation for the improvement of its harbor. There is no other town of its size but what has received some aid from the Government, and it seems to me that our peculiar location, our important interests, and our rapid growth, with the present population of over 20,000, require that we should receive some attention from the Government, but which we have never yet received.

Mayor STOY. I will now introduce, Major Raymond, a representative of the hotel and boarding-house fraternity, who have had a great deal to do with the upbuilding of our town, and he will show what interest they have in the improvement of this inlet. I introduce now Mr. James D. Southwick.

Mr. JAMES D. SOUTHWICK. Major, I think the improvement of the inlet will be of great interest to the people of Atlantic City. In connection with the improvement there are one or two things to which I should like to call your attention.

I have been asked to represent the hotel and boarding-house keepers of Atlantic City, which is next to the transportation interests of the United States; the transportation interests of the United States come first, the hotel and boarding-house keepers' interest comes next, so that when you benefit the city you are benefiting the hotel and boarding-house interests of Atlantic City, and the next largest industry in the country as represented at Atlantic City.

As to the scientific way of widening and deepening the inlet, I leave that to your good judgment, for we know that you represent a Government second to none in scientific research.

The hotel and boarding-house interests of Atlantic City ask the Government of the United States to encourage the capitalists who would build a line of steamships to come to Atlantic City, as they want to do. I am credibly informed, by no less a man than John L. Young, that they have been after him time and time again to get permission for them to land passengers at the end of the pier. At Long Branch and

Asbury Park there is a line of steamers that run to there from New York. Give us a sufficient depth of water here, and New York capitalists will see to it that a line of steamers will run from New York to Atlantic City, for the people of New York want to come here, and the hotel and boarding-house people want to see them here.

As regards a port of entry and a custom-house, I will leave that to my political friends; they will attend to that. As regards making this a seaport for the shipment of coal, I will leave that to my railroad friends, but the hotel and boarding-house interests of Atlantic City ask the great Government of the United States to give them something. It has never given them anything, but they have given the United States something which no one else has ever given them, the greatest place on earth, Atlantic City, for health or pleasure.

I have yet to find the man who has been away from Atlantic City long enough to have overcome any little prejudice he may have had against the hotel keepers who could say that he was not treated right by Atlantic City people. I have seen crutches thrown away. I have seen people come to Atlantic City carried into their hotels on couches, and I have seen them get up and walk—miracles performed in this great health resort of ours.

Major, widen and deepen the inlet; give us a chance—give us a chance to do something more for the people of the United States.

Mr. S. P. MORRIS (merchant). As a merchant, as a merchant interested in various lines of merchandise, I have looked into this question some, particularly two years ago. I then had an idea of establishing a line of boats to this port, particularly of large size, and when I went to the ship brokers to make my arrangement for these vessels the first question that came up was the depth of water over the bar, and I found that right there on the water problem my scheme failed, just on the probability of shoal water, and I had to throw up the entire scheme. As regards the improvement of the channel, I think it will be of immense interest to the city, especially to the stone people and the brick people. People are putting up buildings now that would formerly have been built of wood but that are now built of brick and stone, and many more would build of brick if there was a lower rate for freight on them. The railroads are in league to keep the rates up, and I am perfectly satisfied that if we had a proper depth of water at the entrance of our harbor we could get a better rate from the railroads.

As for the harm the improvement would do the beach, I think it would improve it if there were a system of jetties to confine the channel, just as it has been shown in the case of the light-house; and taking it in all, I think I express the sentiments of the people when I say that the improvement is badly needed, and I think it will come. We should receive a little consideration at the hands of the United States as well as outsiders.

Mayor STOY. I take great pleasure in introducing one of our most esteeemed citizens, Mr. Lewis Evans.

Mr. LEWIS EVANS. I am not interested in the mercantile business, the pleasure business, or in any other business, but with my long residence here I do believe that to deepen the inlet would be of vast benefit to the interests of Atlantic City, to the pleasure, mercantile, hotel, and all other businesses. I earnestly hope that Major Raymond will see his way clear to recommend this appropriation.

Mayor STOY. I will introduce now, Major Raymond, Prosecutor Perry.

Mr. S. E. PERRY (prosecutor, Atlantic City). I don't know as much about Atlantic City, Major, as a great many other men do, and there are men in the room who could tell very much more about what you want to know than I can—men acquainted with the waterways, men acquainted with the channels. About those things I can not give you any information. I will leave that to them; and that is the kind of information you desire. The question that presents itself to me and largely presents itself to the War Department, is the question of whether or not it is expedient and whether or not the people of Atlantic City wish to have a large sum of money spent in the improvement of their harbor. I presume that question has been met. Now another question comes in: Is the improvement a benefit to Atlantic City alone? No; it is not. Atlantic City is cosmopolitan. We have property valued at an amount of $15,000,000, which ten years ago was valued at only about $5,000,000. We represent a population of at least 25,000, which ten years ago was only about 5,000. We represent to-day the people of this country. Widen this channel, and you don't do it for Atlantic City alone; you deepen it for the people of New York, for the people of Boston, for the people of Pennsylvania, the District of Columbia, and Maryland. All these are deeply interested in this improvement, and you need not charge it up to the people of Atlantic City, but you can charge it to the people of the United States.

As I have said before, we have to-day a population of over 25,000, but in the summer time it is a population of over 100,000 people, who are here for over three months each year, and who are benefited, as well as the people of Atlantic City, when you grant this improvement. It is not alone the people of Atlantic City that ask you to do this for them, they are joined by the people from all parts of the United States—you don't give it alone to the people of Atlantic City, and you don't give it alone to the people of the United States that come here, but you give it to those that want to come here, the most healthy seaside resort in this world. The people of the West, the South, and the East all ask you to give this improvement to Atlantic City.

Mayor STOY. Major Raymond, the names on my list have now run out, but there may be others in the room who might be interested in this improvement, and who might wish to speak on this subject. I hope you will give them a few moments if they wish to say anything.

Major RAYMOND. I shall be very glad to hear from any gentleman in the room.

Mr. S. B. ROSE (councilman). I have been a resident of Atlantic City a good many years now, and I remember when the jetties were built by the Government to protect the light-house it was thought by the people on the beach front that that would injure the bathing, but the beach has not been injured, and it has since been improved by the addition of about $500,000 worth of property.

As regards a harbor of refuge, I think the Government of the United States owes it to the sailors and ships that travel the Atlantic Ocean. A harbor of refuge is due every sailor, from the cabin boy up, and they want a port of entry here. You know as well as I do that the Delaware Breakwater is not much of a shelter to ships—it is nothing more than a stone pile; but in this place, if ships could get in, they would be sheltered on every side by land. As you have been told, there was a time when it was common to see from 50 to 75 sail of vessels lying here.

Another thing, we have the greatest railroad accommodations in the world for a town of this size. If this place was made a port of entry, steamships could come in here instead of going up the Delaware. They could land their passengers here, saving about twenty-four hours' time, and in an hour or two they could be in Philadelphia, and the cargo could be shipped the same way.

The United States owes it to the sailors and to the shipping interests to make this port a port of entry and a harbor of refuge, for these men pay their share of the taxes.

Mr. WARREN SOMERS. One of the things most required along this coast, Major, is a harbor of refuge. There is now no place between Sandy Hook and Cape May Breakwater where vessels caught in a storm between those two places can enter. As a result of that, the beaches between these places are strewn with the wrecks of vessels which, if there had been enough water, could have run into Absecon Inlet. The best part of the wrecks lying on the coast could have been prevented if there had been 10 feet of water over Atlantic City bar.

Mr. G. H. GENESS. This question of the improvement of Absecon Inlet interests not only Atlantic City, but also the territory adjoining Atlantic City. The people of Pleasantville are interested in it. Everyone is interested in it.

There are one or two things which I would like to say here. You have started right; you have got one of the most intelligent engineers in sympathy with you, and that makes a great difference. I have had some experience of matters of this kind when they have come up for consideration in the committees of Congress, and I have seen how the appropriations are cut down. The Member from one of the lake districts with a little bill for the improvement of some little harbor or river in his district goes to the Member who has a bill for the improvement of a harbor on the seacoast, and he says, "Tickle me and I'll tickle you," and they both vote for each other's bill, but that doesn't prevent it from being cut down. It is an easy matter to cut an appropriation, but it is not an easy matter to get an appropriation through Congress for an improvement. I have seen how they were cut down, and very often wiped out, and I say to you now that if you want $100,000 ask for $1,000,000.

Capt. JOHN CODMAN. I am not a native of Atlantic City, although I am interested in this improvement, for I am a sea captain. I want to say that a harbor of refuge into which ships that draw 30 feet of water could come would be a great thing for the sailors and vessels that trade along this coast, and I think this is the place for it; not only that, but you should get an appropriation from Congress to construct a canal from here to the city of Philadelphia, and ships for that place entering here would save the long trip around the capes.

Mr. JOHN KATES. Gentlemen, as Major Raymond desires to get information on this subject, I suggest that the mayor be authorized to appoint a committee to confer with Major Raymond to find out what particular kind of information would be most suitable for helping along this improvement, so that this committee can get the information desired, and it can then be forwarded to him, and by him to the Secretary of War. I think if you adopt this plan it will help the progress of the movement.

Major RAYMOND. My authority from the Department is simply for the holding of a hearing, and it would be outside of my instructions to suggest to the citizens of Atlantic City any arguments for or against the improvement of Absecon Inlet; but I will say, as I said before, any information which can be obtained for me with reference to the commercial statistics of navigation, and statistics of the inlet and of the desirability of improving it, I shall be very glad indeed to receive, so that all the gentlemen present to-day, or any others, may collect these statistics and send them to me at Philadelphia. I will incorporate them in my report and forward them to the Secretary of War, and I shall be very glad to receive such information.

Mr. B. L. STEVENS. Major Raymond, I would like to see this harbor improved so that it could be used as a harbor of refuge. It would be a great advantage in time of war, such as a war with Spain, for our boats could lie in this harbor until war was declared, when they could issue out to protect our coast, and they would always have a safe harbor to run to in case of a storm. This is only a little suggestion.

Mayor STOY. I will not take up your time by any remarks, Major Raymond, since I have nothing to suggest other than what has been said. I think that the people of Atlantic City appreciate by their presence here your coming to Atlantic City, and your efforts to do for us what probably no one else can do for us at the present time. I have nothing further to offer, Major.

Major RAYMOND. If there are no others present who desire to say anything on this subject, I will simply say that I am very much gratified by the character of this meeting, and very much interested in what has been said, and I assure you that all your remarks will be given the very closest attention by me, and they will be forwarded to the Secretary of War with my recommendations, and any other information which I can obtain bearing upon the question of this improvement I shall be very glad to receive and send with it.

If no gentleman present desires to say anything, I will declare this meeting adjourned.

APPENDIX I.

IMPROVEMENT OF RIVERS AND HARBORS IN DELAWARE, IN MARYLAND EAST OF CHESAPEAKE BAY, AND OF INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

REPORT OF WM. F. SMITH, UNITED STATES AGENT, MAJOR OF ENGINEERS, UNITED STATES ARMY, RETIRED, IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Wilmington Harbor, Delaware.
2. Ice Harbor at Newcastle, Del.
3. Appoquinimink River, Delaware.
4. Smyrna River, Delaware.
5. Murderkill River, Delaware.
6. Mispillion River, Delaware.
7. Broadkiln River, Delaware.
8. Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del.
9. Susquehanna River above and below Havre de Grace, Md.
10. Chester River, Maryland, from Crumpton to Jones Landing.
11. Choptank River, Maryland.
12. La Trappe River, Maryland.
13. Warwick River, Maryland.
14. Broad Creek River, Delaware.
15. Nanticoke River, Delaware and Maryland.
16. Wicomico River, Maryland.
17. Manokin River, Maryland.
18. Pocomoke River, Maryland.
19. Queenstown Harbor, Maryland.
20. Rockhall Harbor, Maryland.
21. Removing sunken vessels or craft obstructing or endangering navigation.

United States Engineer Office,
Wilmington, Del., July 18, 1898.

General: I have the honor to transmit herewith the annual report for the works of river and harbor improvement in my charge for the fiscal year ending June 30, 1898.

Very respectfully, your obedient servant,

Wm. F. Smith,
United States Agent.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

I 1.

IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 159.

The amount expended for the improvement of the harbor to June 30, 1897, is $378,201.84, of which $262,345.84 was expended on the project of 1881 and its modifications.

At the beginning of the fiscal year operations were in progress under contract with the Atlas Dredging Company, dated May 11, 1897. Under this contract, which was begun June 24, 1897, the channel had been dredged to a depth of 15 feet at mean low water from a point opposite the Atlantic Refining Company's wharf, in an upriver direction, for a length of 785 feet, of which 385 feet were of the approved width, 150 feet, and the remainder only 100 feet. These operations were continued to September 1, 1897. The channel had then been dredged to a point about 950 feet below the Market Street Bridge. A channel 150 in width, with a minimum depth of 15 feet at mean low water, was dredged between the points named, and at the Third Street Bridge the channel was widened to 200 feet, in order to embrace both draws of the bridge. It then became necessary to stop dredging in this part of the river in order that with the small balance of funds available some relief might be obtained at the mouth of the river. Accordingly, under a supplementary contract dated August 26, 1897, a bar, which had formed there since the work of 1896, was removed, giving the channel there a width of 150 feet with a minimum depth of 15 feet at mean low water. The material removed, 108,480 cubic yards, consisted of mud, which was scowed away and dumped into a "pocket" and then pumped ashore by means of a hydraulic dredge. A survey, made upon the completion of each section of the work in the river after its completion, developed the fact that for nearly the whole length of the channel just dredged the soft mud had washed into the cut, contracting its bottom width to an average of 120 feet, the channel depth remaining 15 feet. Immediately above the wharves of the Philadelphia and Wilmington Steamboat Company the channel had contracted so that at one point the 15-foot channel was but 25 feet wide. On either side of this point the channel widened out again. This contraction was undoubtedly caused by the propellers of the large steamboats sucking mud in from the sides.

No contract for work in excess of appropriations under the authorization given in the act of June 3, 1896, has been entered into for this improvement, in view of the modification recommended by the Board of Engineer Officers in Report of October 3, 1896 (page 1259, Part II, Report of Chief of Engineers for 1897), and the necessity for an increase in the limiting cost.

The important commercial interests of this city warrant liberal expenditures in making and maintaining a proper channel.

It is proposed to expend the amount asked for, if appropriated, in continuing work as approved.

Wilmington is a port of entry and in the collection district of Delaware. The amount of revenue collected there during the fiscal year ending June 30, 1898, was $23,446.

Money statement.

July 1, 1897, balance unexpended	$23, 992. 94
June 30, 1898, amount expended during fiscal year	23, 992. 20
July 1, 1898, balance unexpended	.74
Amount (estimated) required for completion of existing project	476, 625. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	200, 000. 00
Amount required for maintenance in fiscal year ending June 30, 1900	20, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved—		
July 14, 1836	$15,000	
March 3, 1837	8,000	
July 7, 1838	9,356	
July 11, 1870	15,000	
June 10, 1872	10,000	
March 3, 1873	6,000	
June 23, 1874	6,000	
March 3, 1875	10,000	
August 14, 1876	16,000	
June 18, 1878	7,000	
March 3, 1879	3,500	
June 14, 1880	10,000	
		$115,856
By act approved March 3, 1881	50,000	
By act passed August 2, 1882	50,000	
By act approved—		
July 5, 1884	25,000	
August 5, 1886	18,750	
By act of August 11, 1888	30,000	
By act approved—		
September 19, 1890	30,000	
July 13, 1892	40,000	
By act of August 18, 1894	25,000	
By act of June 3, 1896	20,000	
		288,750
Aggregate		404,606

Of the above the sum of $2,411.22 has been carried to the surplus fund of the Treasury.

COMMERCIAL STATISTICS OF THE CITY OF WILMINGTON FOR THE CALENDAR YEAR 1897.

[Furnished by the Wilmington Board of Trade.]

The tonnage and value of leading articles shipped to and from the port of Wilmington by water during the year 1897 are as follows:

Domestic commerce.

Articles.	Tons.	Value.
Coal	35,125	$87,475
Cord wood	4,225	16,985
Iron and steel supplies	49,985	971,975
Rubble and quarry stone	72,175	172,935
Building and molding sand	43,185	22,925
Ice	2,615	4,125
Cement	5,115	45,435
Machinery	16,115	125,925
Fertilizers	19,975	125,240
Sawed lumber	15,235	121,120
Powder	2,395	158,925
General merchandise	129,575	16,791,525
Miscellaneous and unclassified	187,875	7,225,350
Total	583,595	25,869,940

Foreign commerce.

Articles.	Quantity.	Value.
Imports:		
Goat hides ... bales	727	$26,321
Rock phosphate ... tons	2,146	1,300
Nitrate of soda ... do	5,234	162,263
Laths ... number	500,000	1,000
Cornish stone ... tons	1,423	6,500
Miscellaneous		10,000
Total		207,384
Exports:		
Barrel material		10,000
Machinery		4,000
Petroleum, crude ... gallons	69,200,000	2,670,255
Petroleum, refined ... do	20,300,000	1,666,000
Total		4,350,255
Total foreign imports and exports		4,557,639

VESSELS ENGAGED IN FOREIGN TRADE.

There are engaged in foreign trade from this port (Marcushook) 90 vessels, of an aggregate tonnage of 157,983 tons, and average draft of 23 feet, carrying petroleum.

Vessels trading in Wilmington Harbor.

Class.	Number.	Aggregate tonnage.	Draft.
			Feet.
Steamers	5	1,670	6 to 10
Tugs	9	485	4 to 8
Schooners	8	550	
Barges	17	7,825	
Total	39	10,530	

The above vessels are engaged in daily river and harbor work. In addition, there are numerous vessels of all classes engaged in general coastwise trade, of which no distinct record is kept.

There is invested in freight and passenger lines between Wilmington, Del., Philadelphia, Pa., and Pennsgrove, N. J., over $1,000,000. These vessels carry annually 530,000 passengers, and freight valued at $16,500,000.

There is invested in manufacturing and mercantile interests on the Christiana River, all dependent upon the facilities of this river navigation, between $12,000,000 and $13,000,000.

The following statistics of vessels built and repaired at Wilmington, Del., were furnished by the Harlan & Hollingsworth Company, Jackson & Sharp Company, and the Pusey & Jones Company, of Wilmington, Del. They do not embrace all the work of that character done, but only that by the companies named.

Vessels built.

Class.	Number.	Aggregate tonnage.	Draft.
			Feet.
Passenger and freight steamer, iron	1	2,552	
Passenger and freight steamer, composite iron, steel, and wood	1	146	
Freight steamer, composite steel, iron, and wood	1	75	
Tug boat, iron	1	179	10 to 16½
Tug boats, wooden	2	107½	
Steam yacht, iron	1	435	
Schooner yacht, iron	1	185	
Pilot boat, iron	1	541	
Barges and scows, wooden	8	6,880	
Total	17	11,100½	

Vessels repaired.

	Aggregate tonnage.
Steamers	57,403
Sailing vessels	11,724
Barges and scows	12,750
Total	81,877

I 2.

IMPROVEMENT OF ICE HARBOR AT NEWCASTLE, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 160.

The amount expended for the improvement of the harbor to June 30, 1897, was $224,703.84, of which $22,539.95 was on the project of 1884.

During the past fiscal year, under authority of the Chief of Engineers, Piers L, K, and C were repaired, at a cost of $244.25, derived from allotment from appropriation "Examinations, surveys, and contingencies of rivers and harbors." The work consisted mainly in replacing stones which were broken or out of position.

No statistics were obtainable.

Newcastle is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1898, is $23,446.

AMOUNTS APPROPRIATED.

By act approved—	
May 20, 1826	$25,000.00
March 2, 1829	17,895.99
July 2, 1836	25,000.00
March 3, 1837	10,000.00
July 7, 1838	11,573.00
August 30, 1852	15,000.00
July 15, 1870	2,500.00
June 10, 1872	27,000.00
March 3, 1873	20,000.00
June 23, 1874	10,000.00
March 3, 1875	20,000.00
August 14, 1876	12,000.00
By act approved—	
June 18, 1878	$10,000.00
March 3, 1879	5,500.00
June 14, 1880	3,000.00
March 3, 1881	20,000.00
July 5, 1884	2,000.00
August 5, 1886	5,000.00
By act of August 11, 1888	7,500.00
By act approved September 19, 1890	8,100.00
	257,068.99

Of the above, the sum of $32,365.15 has been carried to the surplus fund of the Treasury.

I 3.

IMPROVEMENT OF APPOQUINIMINK RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 161.

No dredging has been done during the past fiscal year. The contract made with Egan & Bochman, dated July 2, 1897, has been extended to December 31, 1898, and work thereunder is expected to be begun in a few days.

It is proposed to expend the amount asked for, if appropriated, in continuing work under the project.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1898, is $23,446.

Money statement.

July 1, 1897, balance unexpended	$9,111.02
June 30, 1898, amount expended during fiscal year	101.06
July 1, 1898, balance unexpended	9,009.96
July 1, 1898, amount covered by uncompleted contracts	9,009.96
Amount (estimated) required for completion of existing project	19,963.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved September 19, 1890	$5,000
By act approved July 13, 1892	5,000
By act of August 18, 1894	5,000
By act of June 3, 1896	5,000
Total	20,000

Contract in force with Egan & Bochman, dated July 2, 1897, for dredging certain rivers in Delaware. Time for beginning work, August 15, 1897, and for expiration, July 15, 1898. Time extended six months.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, fertilizers, flour, etc	6,350	$57,400
Horses, sheep, etc	650	60,500
General merchandise	3,600	525,400
Total	10,600	643,300
Shipments:		
Canned goods	425	27,500
Fruit, wheat, poultry, sheep, etc	10,300	603,050
General merchandise	100	10,000
Total	10,825	640,550
Total receipts and shipments	21,425	1,283,850

Vessels trading in Appoquinimink River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	100	7	Triweekly 2 months and then semiweekly.
Tugs	3		7	Transient.
Schooners	2	205	6½	Do.
Barges	3	675	6	Do.
Total	9	980		

The above statistics were furnished by Mr. F. B. Watkins, Odessa, Del.

I 4.

IMPROVEMENT OF SMYRNA RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 162.

The total amount expended on this improvement to June 30, 1897, is $32,963.10, of which $22,963.10 was on this project.

Under contract dated June 15, 1897, made with Egan & Bochman, for the expenditure of the appropriation of $5,000 made by the river and harbor act of June 3, 1896, dredging was begun on December 8, 1897, at Cave Landing and continued thence downstream to Cherrytree Reach. In this section shoals at Cave Landing, at Long Reach, the entire length of Gravel Reach and lower end of canal, and thence to Eagle Nest Landing, the upper end of Northwest Branch, and at and through Cherrytree Reach, aggregating 10,996 feet in length, were dredged, resulting in a channel of the approved dimensions from Cave Landing downstream for a length of 13,705 feet, with the exception of about 300 feet just below Eagle Nest Landing, where the depth and width are at some places slightly less. The channel below Cherrytree Reach to the mouth is in a fair condition, but needs some dredging at several points to give the approved dimensions.

In the section above Cave Landing the most troublesome shoals were removed. These were at Deep Hole, one just below Rothwells Landing, the upper end of Mill Creek Canal, Beaver House, and about 900 feet of a shoal at Walraven Reach, aggregating 4,275 feet, were dredged to the approved dimensions, except the one at Deep Hole, where the width made was only 50 feet, giving an unobstructed navigation from Cave Landing upstream for a length of 15,470 feet, to Walraven Reach.

The amount asked for is for completion of the project for dredging, and, if appropriated, will be expended accordingly.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, and the amount of revenue collected there during the fiscal year ending June 30, 1898, is $23,446.

Money statement

July 1, 1897, balance unexpended		$5,036.90
June 30, 1898, amount expended during fiscal year		3,998.66
July 1, 1898, balance unexpended		1,038.24
July 1, 1898, outstanding liabilities	$850.00	
July 1, 1898, amount covered by uncompleted contracts	130.00	
		980.00
July 1, 1898, balance available		58.24
Amount (estimated) required for completion of existing project		9,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		9,365.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

AMOUNTS APPROPRIATED.

By act approved—		
June 14, 1880	$5,000	
March 3, 1881	3,000	
By act passed August 2, 1882	2,000	
		$10,000

By act of August 11, 1888	$10,000	
By act approved—		
September 19, 1890	5,000	
July 13, 1892	3,000	
By act of August 18, 1894	5,000	
By act of June 3, 1896	5,000	
		$28,000
Aggregate		38,000

Contract in force with Egan & Bochman, dated July 2, 1897, for dredging certain rivers in Delaware. Time for beginning work, August 15, 1897, and for expiration, July 15, 1898. Time extended six months.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, iron, steel, phosphate, etc	6,600	$75,000
Canned goods, fertilizers, mill work, etc	8,845	213,180
Cattle, grain, horses, sheep, etc	49,913	248,800
General merchandise	10,000	400,000
Total	75,358	936,980
Shipments:		
Railroad ties, ship timber, wood, etc	82,400	209,000
Canned goods, crates, baskets, terra cotta, etc	132,065	833,500
Fruit, grain, cattle, poultry, etc	20,857	760,450
General merchandise	5,000	200,000
Total	240,322	2,002,950
Total receipts and shipments	315,680	2,939,930

Vessels trading in Smyrna River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	4	330	5 to 6	Two and three trips weekly.
Tugs	2		6	With coal floats, barges, etc.
Schooners	2			Charter, carrying grain, fertilizers, etc.
Barge	1			

The above statistics were furnished by A. E. Jardine, secretary of the Philadelphia and Smyrna Transportation Company.

I 5.

IMPROVEMENT OF MURDERKILL RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 163.

The amount expended to June 30, 1897, was $18,328.68. In addition to this, $1,500 was expended in removing a shoal at the mouth of the St. Jones River, in accordance with requirement of the river and harbor act of August 18, 1894.

No work has been done on the improvement during the past fiscal year.

The amount asked for, if appropriated, will be expended in dredging at the bar and in the river, in continuation of the project.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1898, is $23,446.

Money statement.

July 1, 1897, balance unexpended	$171.32
June 30, 1898, amount expended during fiscal year	153.87
July 1, 1898, balance unexpended	17.45
Amount (estimated) required for completion of existing project	32,764.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved July 13, 1892	$7,000
By act of August 18, 1894	*6,500
By act of June 3, 1896	6,500
Total	20,000

COMMERCIAL STATISTICS FOR CALENDER YEAR 1897.

Receipts and shipments.

Class.	Total.	Value.
Receipts:		
Bone, rock phosphate, timber, etc	6,557	$69,480
Lime, fertilizers, dressed lumber, etc	8,400	67,000
Horses, hay, etc	950	25,450
General merchandise	850	68,000
Total	16,757	229,930
Shipments:		
Cord wood, pine and oak piles	15,978	31,380
Canned goods, barrels, etc	2,115	109,200
Corn, wheat, fruit, cattle, etc	6,932	157,500
General merchandise	760	53,200
Total	25,785	351,280
Total receipts and shipments	42,542	581,210

Vessels trading in Murderkill River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	1	300	6½	Semi-weekly.
Schooners	5	225	4 to 6	Weekly.
Total	6	525		

One steamer and 5 sailing vessels, aggregate tonnage 720, repaired during the year.

The above statistics were furnished by Mr. Caleb J. Smithers, Frederica, Del.

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* Of this amount $1,500 was expended in removing shoal at mouth of St. Jones River.

I 6.

IMPROVEMENT OF MISPILLION RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 164.

The amount expended on this improvement to June 30, 1897, is $34,629.67, of which $17,629.67 is on the present project.

During the fiscal year a brush and stone extension to the pile dike constructed the preceding year has been built. It was done under contract with B. T. Collins, dated June 25, 1897. Work was begun July 14 and completed August 21, 1897. The extension is 200 feet in length and is built up to the level of mean high water, with a top width of 5 feet.

Under a contract for dredging, made with Egan & Bochman, dated July 2, 1897, work was begun on September 24 on the inner edge of the shoal near the end of the crib dike, inside of the river, by dredging a cut 50 feet wide and 6 feet deep at mean low water. This was continued with many interruptions, mainly on account of stormy weather, until November 9, when the cut had been made for a length of 458 feet. The stormy weather continuing, dredging was suspended and an attempt made to raise with the dredge the loose portion of the crib dike, the end of which had been undermined during the gales of the latter part of October and early in November. One crib was removed. Dredging operations were resumed on November 18, in extending the channel across the Bulkhead Shoal, about 400 feet beyond the mouth, the condition of the channel having changed so much during the gales referred to that the widening of the 50-foot cut was found to be unnecessary. The effect of the storms was the shoaling to 4 feet of the cut which had been dredged to 6 feet and the making of a 4-foot channel of sufficient width for present needs. A cut across the Bulkhead Shoal was then made, 4 feet deep and 40 feet wide, for a length of 675 feet, resulting in a continuous channel 4 feet deep at mean low water from inside the river to and across the Bulkhead Shoal, outside. The quantity of material dredged was 6,254 cubic yards and consisted principally of sand, gravel, and mud. That from the inner work was deposited upon the bay shore north of the angle in the pile jetty, and that from the Bulkhead Shoal on the west side of the cut. The contract for this work was closed November 30, 1897.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1898, is $23,446.

Money statement.

July 1, 1897, balance unexpended	$4,370.33
June 30, 1898, amount expended during fiscal year	4,257.75
July 1, 1898, balance unexpended	112.58
July 1, 1898, outstanding liabilities	112.58
Amount (estimated) required for completion of existing project	2,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	2,000.00
Amount required for maintenance during fiscal year ending June 30, 1900	500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved—		
March 3, 1879	$3,000	
June 14, 1880	4,000	
March 3, 1881	3,500	
By act passed August 2, 1882	3,000	
By act of August 11, 1888	3,500	
		$17,000
By act approved July 13, 1892	12,000	
By act of August 18, 1894	10,000	
		22,000
Aggregate		39,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Raw bone, rock phosphate, etc	31,971	$549,510
Chemicals, lumber, etc	4,918	62,296
Hay, dry goods, hardware, etc	3,895	105,475
Tin plate	203	8,688
Total	40,987	725,969
Shipments:		
Railroad ties, timber, wood, etc	23,237	122,098
Canned goods, fertilizers, sawed lumber, etc	11,792	636,647
Grain, fruit, cattle, etc	6,913	187,990
General merchandise	400	4,000
Total	42,142	950,735
Total receipts and shipments	83,129	1,676,704

Vessels trading in Mispillion River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamboat	1	100	5	Semiweekly.
Tugs	3	33	4½ to 5½	Daily; towing.
Schooners	18	1,250	4 to 6	Irregularly; carrying coal, wood, oysters, and general merchandise.
Sloops	2	45	3½ to 4	Oysters and rock.
Barges	14	5,600	4½	Railroad ties, piles, sand, etc.
Tugs	1	....	....	Towing rafts.
Total	39	7,028		

One steamer and 16 sailing vessels, of an aggregate of 2,100 tonnage, were repaired during the year.

The above statistics were furnished by Mr. George F. Pierce, of Milford, Del., accompanied by the following letter:

MILFORD, DEL., *February 5, 1898.*

SIR: I have the honor to transmit herewith report of commerce on Mispillion River for the year ending December 31, 1897. Other duties have prevented an earlier compliance.

These statistics have been collected with as much care as possible. You will please observe that there has been a considerable increase in phosphates and canned goods. We now have two of the largest phosphate works in the State and two of probably the largest canning establishments. A freight and passenger steamboat from Philadelphia to Milford has been running twice a week since the summer and will run regularly when the weather opens. Another steamer, 120 feet long, will be put on, probably this year. The pressing needs for piles for the Philadelphia Harbor improvement and the indisposition of our vessels to drop other freight to carry piles has compelled the contractors to raft them with tug power. A steam tug of ample horsepower is now on the stocks here.

I have the honor to be, very respectfully,

George F. Pierce.

Gen. William F. Smith,
United States Agent.

I 7.

IMPROVEMENT OF BROADKILN RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 166.

The amount estimated for the completion of the existing project is for the improvement at the mouth of the river as designed in 1871 and modified in 1881. No work has been done on it since 1890, and no funds have been available for the purpose. I do not recommend any expenditure at present for an outlet for the Broadkiln into Delaware Bay, taking into consideration that success in making it will be most uncertain and the probability that the Broadkiln can be connected with the inland waterway from Chincoteague Bay to Delaware Bay at Lewes at much less cost and with greater advantage to both.

This work is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected during the fiscal year ending June 30, 1898, is $23,446.

It was not practicable to obtain commercial statistics.

Money statement.

Amount (estimated) required for completion of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	$21,500.00

AMOUNTS APPROPRIATED.

By act approved—		By act passed August 2, 1882	$5,000
March 3, 1873	$10,000	By act of August 11, 1888	10,000
June 14, 1880	5,000		
March 3, 1881	5,000	Total	35,000

I 8.

IMPROVEMENT OF INLAND WATERWAY FROM CHINCOTEAGUE BAY VIRGINIA, TO DELAWARE BAY, AT OR NEAR LEWES, DELAWARE.

For previous history see Annual Report of Chief of Engineers for 1898, Part I, page 166.

The amount expended on this improvement to June 30, 1897, was $166,697.70.

The river and harbor act of June 3, 1896, appropriated $25,000 for continuing this improvement, to be used from Delaware Bay to Indian River, and provided "that no part of this appropriation shall be expended until the right of way is secured without cost to the United States, but the right of way over any railroad or county bridge shall not be subject to this proviso and may be secured by condemnation proceedings."

It was supposed that the United States had secured the right of way along the entire length of the canal, but, as stated in my report for 1895, the Delaware, Maryland and Virginia Railroad Company denies this as to its railroad crossings over the line of the canal, and that matter is now in litigation. Until that and possibly other disputes as to title are disposed of it is not likely that much, if any, dredging work can judiciously be done under the project.

During the fiscal year efforts have been directed toward obtaining title to the crossing, the Department having decided to condemn the land. It was also decided by the Department of Justice to proceed under the State statute, as I was informed by letter of October 15, 1897, by the United States attorney for the district of Delaware. Under this statute, and upon advice of the district attorney, an offer has been made by the Department to the railroad company for the conveyance of title to the United States, and commissioners have been appointed for the purpose of appraising the value of the company's title. They have had a meeting at Rehoboth and are to have a further meeting at Wilmington upon call of the district attorney. As the commissioners of Rehoboth, the successors of the Rehoboth Beach Association, may have some remaining title to the land, upon advice of the district attorney an offer has been made to them also. This offer Governor Tunnell, who is one of the members, informed me in April last would be laid before the Board at its next meeting.

The amount asked for, if appropriated, will be expended in continuing the improvements between Chincoteague Inlet and Delaware Bay. The most useful work to be done is between Ocean City, Md., and Indian River Bay.

Money statement.

July 1, 1897, balance unexpended	$27,052.30
June 30, 1898, amount expended during fiscal year	551.66
July 1, 1898, balance unexpended	26,500.64
Amount (estimated) required for completion of existing project	156,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act of August 5, 1886	$18,750
By act of August 11, 1888	50,000
By act approved September 19, 1890	50,000
By act approved July 13, 1892	25,000
By act of August 18, 1894	$25,000
By act of June 3, 1896	25,000
Total	193,750

I 9.

IMPROVEMENT OF SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, MARYLAND.

The project for improvement above and below Havre de Grace includes the making of a 15-foot low-water channel below the town and the removal of the shoal on the west side of the channel opposite Watson-

Island, above Havre de Grace, to a depth of 8 feet below mean low water. The channel below the town was dredged to a depth of 12 feet in 1885. The survey of December, 1891, showed that it had partially shoaled again. The removal of the eastern bank of the shoal opposite Watson Island has been in progress since 1883, and is done to prevent in a measure the formation of ice gorges at or near the town of Port Deposit, situated 2¼ miles above the island. About $32,000 has been expended in dredging this shoal, resulting in some temporary relief, but the survey above referred to and that of 1894 show that the area dredged had resumed nearly its original state since the work was suspended in 1889.

Up to the close of the fiscal year ending June 30, 1897, $161,067.37 had been expended on this section of the river, including $49,729.15 expended for dredging the channel to the Fishing Battery Light-House, for breakwaters and piers, and for other work for the Fish Commission.

The funds on hand are of the appropriations of 1890, 1892, and 1894. As the amount is small and is limited for expenditure above the Philadelphia, Wilmington and Baltimore Railroad Bridge, no work has been undertaken the past fiscal year, but some dredging at Watson Island may be needed soon.

Susquehanna River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1898, is $1,780,253.99.

It was impracticable to obtain complete commercial statistics.

Money statement.

July 1, 1897, balance unexpended	$9, 822. 63
July 1, 1898, balance unexpended	9, 822. 63
Amount (estimated) required for annual dredging Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	20, 000. 00

AMOUNTS APPROPRIATED.

By act approved—		
August 30, 1852	$10, 000	
June 23, 1866	26, 400	
July 25, 1868 (allotment)	5, 000	
April 10, 1869 (allotment)	990	
July 11, 1870	12, 000	
June 14, 1880	28, 000	
March 3, 1881	15, 000	
		$97, 390
By act passed August 2, 1882	25, 000	
By act approved—		
July 5, 1884	20, 000	
August 5, 1886	6, 000	
By act of August 11, 1888	10, 000	
By act approved—		
September 19, 1890	4, 000	
July 13, 1892	4, 000	
1879, allotment from general appropriation for examinations and surveys	500	
By act of August 18, 1894	4, 000	
		73, 500
Aggregate		170, 890

I 10.

IMPROVEMENT OF CHESTER RIVER, MARYLAND, FROM CRUMPTON TO JONES LANDING.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 167.

The amount expended on this improvement to June 30, 1897, was $9,480.90.

No work has been done during the year. The contract made with Chester T. Caler for dredging has been extended to December 31, 1898.

The amount asked for, if appropriated, will be expended in completing the project.

This work is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1898, is $1,780,253.99.

Money statement.

July 1, 1897, balance unexpended	$1,519.10
July 1, 1898, balance unexpended	1,519.10
July 1, 1898, amount covered by uncompleted contracts	1,500.00
July 1, 1898, balance available	19.10
Amount (estimated) required for completion of existing project	3,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	3,250.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved—	
September 19, 1890	$5,000
July 13, 1892	3,000
By act of August 18, 1894	1,500
By act of June 3, 1896	1,500
Total	11,000

Contract in force with Chester T. Caler, dated December 24, 1896, approved January 5, 1897, for dredging certain rivers and harbors on eastern shore of Chesapeake Bay. Time for beginning work, January 15, 1897, and expiration, June 30, 1898. Time extended to December 31, 1898.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

CHESTER RIVER STEAMBOAT COMPANY,
Baltimore, March 23, 1898.

SIR: Herewith we hand you the information as to value of business of this company for the year 1897.

Sorry that we can not give you the information in detail.

We brought to Baltimore from points on Chester River 48,075 tons of freight. We took to points on Chester River 28,044 tons.

These figures include the amount of business done over our entire route.

Yours, respectfully,

GEO. WARFIELD, *President.*

Gen. WILLIAM F. SMITH,
United States Agent.

Vessels trading in Chester River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Screw steamer	1	360	7½	Daily part of the year, and then triweekly.

I 11.

IMPROVEMENT OF CHOPTANK RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 168.

For the expenditure of the appropriation of $2,000 made by the river and harbor act of June 3, 1896, contract for dredging has been made with Chester T. Caler, of Norfolk, Va. This work was to have been completed by June 30, 1898. The contract has been extended to December 31, 1898.

It is proposed to expend the amount asked for, if appropriated, in continuing dredging under the project.

Choptank River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1898, is $1,780,253.99.

Money statement.

July 1, 1897, balance unexpended	$1,840.37
July 1, 1898, balance unexpended	1,840.37
July 1, 1898, amount covered by uncompleted contract	1,840.37
Amount (estimated) required for completion of existing project	16,000 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—	
June 14, 1880	$5,000
March 3, 1881	5,000
By act passed August 2, 1882	5,000
By act approved—	
July 5, 1884	5,000
August 5, 1886	10,000
By act of August 11, 1888	7,500
By act approved—	
September 19, 1890	7,500
July 13, 1892	3,000
By act of August 18, 1894	2,000
By act of June 3, 1896	2,000
Total	52,000

Contract in force with Chester T. Caler, dated December 24, 1896, approved January 5, 1897, for dredging certain rivers and harbors on eastern shore of Chesapeake Bay. Time for beginning work, January 15, 1897, and expiration, June 30, 1898. Time extended to December 31, 1898.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Ice, oysters, fish, etc	116	$1,680.00
Canned goods, fertilizers, lumber, etc	3,721	99,199.82
Cattle, horses, sheep, etc	396	46,473.50
General merchandise	7,000	280,000.00
Total	11,233	427,353.32
Shipments:		
Canned goods, lumber, flour, etc	1,498	68,205.94
Fruit, cattle, wheat, poultry, etc	7,063	112,312.50
General merchandise	1,900	76,000.00
Total	10,461	256,518.44
Total receipts and shipments	21,694	683,871.76

Vessels trading in Choptank River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	2	1,208	5½	Daily service.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company, and represent the business of that line only.

I 12.

IMPROVEMENT OF LA TRAPPE RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 169.

The amount expended to the close of the fiscal year 1897 was $7,213.87 and the proposed channel within the river had been completed. The proposed channel at the mouth, about 1,600 feet long, had been dredged to the approved width of 150 feet for a distance of 400 feet and to a width of 100 feet only for the remaining 1,200 feet. No work has been done during the past fiscal year. The latter portion, therefore, remains to be widened 50 feet in order to conform to the approved project, and it is estimated that to complete it $2,500 will be required in addition to the amount already expended and originally estimated as the cost of the whole improvement. This increase in the estimate is solely due to shoaling in the upper river since the survey was made and to the treacherous character of the material at the bar. The latter consists principally of live, pure sand, and already, during the progress of the first contract, at that point it became necessary to remove and pay for a much larger quantity of material on that account than was estimated for and the depth of cutting had to be increased to maintain the dredged depth, the contract being for scow measurement. It is expected, however, that the additional amount asked for will complete the channel if no unforeseen shoaling has taken place since operations were suspended.

La Trappe River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1898, is $1,780,253.99

Money statement.

July 1, 1897, balance unexpended	$36.13
July 1, 1898, balance unexpended	36.13
Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	2,500.00
Submitted in compliance with requirements of sections 2 of river and harbor act of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved July 13, 1892	$2,500
By act of August 18, 1894	4,750
Total	7,250

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Logs	500	$10,000
Canned goods	350	20,000
Fruit, vegetables, cattle, etc	2,608	93,412
General merchandise	3,000	120,000
Total	6,458	243,412
Shipments:		
Coal, ice, etc	820	4,500
Fertilizers, flour, etc	1,322	26,812
Potatoes, hay, horses, and sheep	1,608	6,895
General merchandise	3,750	150,000
Total	7,500	188,207
Total receipts and shipments	13,958	431,619

Vessels trading in La Trappe River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	3	1,075	9	Engaged in general trade.
Schooners	4	300	8	
Bug eyes	3	150	6½	
Total	10	1,525		

Two sailing vessels, of aggregate tonnage 250, repaired during year.
The above statistics were furnished by C. C. Wheeler & Co., of Hillsboro, Md.

I 13.

IMPROVEMENT OF WARWICK RIVER, MARYLAND.

For previous history, see Annual Report of the Chief of Engineers for 1898, Part I, page 169.

At the close of the fiscal year ending June 30, 1897, $13,918.82 had been expended for the improvement of this river, of which $7,918.82 was on the present project.

Under contract dated December 24, 1896, made with Chester T. Caler, of Norfolk, Va., for the expenditure of the appropriation of $2,000 made by the river and harbor act of June 3, 1896, dredging was begun on June 20, 1898, at a point 400 feet below Cedar Point, and carried on in an upriver direction to the end of the fiscal year. The channel was widened and deepened where necessary for a distance of 1,900 feet, removing 10,451 cubic yards of material. This was scowed away and deposited in 40 feet of water in the Choptank River, just above Jamaica Point. The channel made was 100 feet wide and 10 feet deep at mean low water, resulting in a channel of the approved dimensions from the Choptank River to Devils Wind Gap. This leaves about 2,050 feet of the channel in the upper river to be dredged to the approved dimensions and some dredging in the turning basin to complete the project. The work on this contract will be completed shortly, the time for the expiration of the contract having been extended by authority of the Chief of Engineers.

It is proposed to expend the amount asked for, if appropriated, in continuing dredging under the project.

Warwick River is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1898, is $1,780,253.99.

Money statement.

July 1, 1897, balance unexpended		$2,081.18
June 30, 1898, amount expended during fiscal year		528.70
July 1, 1898, balance unexpended		1,552.48
July 1, 1898, outstanding liabilities	$950.00	
July 1, 1898, amount covered by uncompleted contracts	550.00	
		1,500.00
July 1, 1898, balance available		52.48
Amount (estimated) required for completion of existing project		8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		6,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved June 14, 1880	$3,000
By act approved March 3, 1881	3,000
Total	6,000
By act approved July 13, 1892	6,000
By act of August 18, 1894	2,000
By act of June 3, 1896	2,000
Total on present project	10,000
Aggregate	16,000

Contract in force with Chester T. Caler, dated December 24, 1896, approved January 5, 1897, for dredging certain rivers and harbors on eastern shore of Chesapeake Bay. Time for beginning work, January 15, 1897, and expiration, June 30, 1898. Time extended to December 31, 1898.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Fish, canned goods, flour, etc	811	$23,212.60
Cattle, horses, etc	175	4,375.20
General merchandise	650	26,000.00
Total	1,636	53,587.80
Shipments:		
Canned goods, fertilizers, etc	365	21,790.00
Fruit, wheat, farm products, etc	1,078	25,711.20
General merchandise	630	25,200.00
Total	2,073	72,701.20
Total receipts and shipments	3,709	126,289.00

Vessels trading in Warwick River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamers	2	1,208	5½	Daily service.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company, and represent the business of that line only. About 100 sloops, bugeyes, and schooners also trade here.

I 14.

IMPROVEMENT OF BROAD CREEK RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Prat I, page 170.

The amount expended to June 30, 1897, was $45,069.26, of which $35,000 was expended before the adoption of the present project and $5,000 for the removal of a bar extending from the railroad bridge at Seaford toward the mouth, on the Nanticoke River.

The river and harbor act of June 3, 1896, appropriated $5,000 for continuing the improvement of Broad Creek River, and contract for dredging has been made with Chester T. Caler, of Norfolk, Va. No work has been done during the past fiscal year. The contract, which embraces other improvements along the eastern shore of Chesapeake Bay, has been extended to December 31, 1898, and it is expected that all the work on it will be completed by that time.

The amount asked for, if appropriated, will be expended in continuing the improvements toward Laurel, in accordance with the project.

Broad Creek is in the collection district of Delaware. Wilmington is the nearest port of entry, at which the amount of revenue collected for the fiscal year ending June 30, 1898, is $23,446.

It was not practicable to obtain complete commercial statistics.

Money statement.

July 1, 1897, balance unexpended	$4,930.74
July 1, 1898, balance unexpended	4,930.74
July 1, 1898, amount covered by uncompleted contracts	4,930.74
Amount (estimated) required for completion of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—	
June 14, 1880	$5,000
March 3, 1881	10,000
By act passed August 2, 1882	5,000
By act approved August 5, 1886	10,000
By act of August 11, 1888	5,000
Total	35,000
By act approved July 13, 1892	$5,000
By act of August 18, 1894	*5,000
By act of June 3, 1896	5,000
Total, present project	15,000
Aggregate	50,000

Contract in force with Chester T. Caler, dated December 24, 1896, approved January 5, 1897, for dredging certain rivers and harbors on eastern shore of Chesapeake Bay. Time for beginning work, January 15, 1897, and expiration, June 30, 1898. Time extended to December 31, 1898.

I 15.

IMPROVEMENT OF NANTICOKE RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 171.

The amount expended on this improvement to June 30, 1897, was $59.12.

No work has been done during the past fiscal year. The contract with Chester T. Caler, dated December 24, 1896, has been extended to December 31, 1898.

Nanticoke River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

Money statement.

July 1, 1897, balance unexpended	$2,940.88
June 30, 1898, amount expended during fiscal year	125.00
July 1, 1898, balance unexpended	2,815.88
July 1, 1898, amount covered by uncompleted contracts	2,815.88
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT APPROPRIATED.

By act of June 3, 1896	$3,000

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* This appropriation was applied to removing bar on Nanticoke River, under the terms of the appropriation.

Contract in force with Chester T. Caler, dated December 24, 1896, approved January 5, 1897, for dredging certain rivers and harbors on eastern shore of Chesapeake Bay. Time for beginning work, January 15, 1897, and expiration, June 30, 1898. Time extended to December 31, 1898.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Raw bone, phosphate, ship timber, etc	242	$5, 211
Chemicals, fertilizers, flour, lumber, etc	3, 495	80, 963
Cattle, horses, hay, etc	535	25, 742
General merchandise	975	39, 000
Total	5, 247	150, 916
Shipments:		
Canned goods, basket and barrel material, lumber, etc	2, 300	145, 550
Berries, peaches, grain, poultry, etc	8, 518	348, 228
General merchandise	950	38, 000
Total	11, 768	531, 778
Total receipts and shipments	17, 015	682, 694

Vessels trading in Nanticoke River, Delaware and Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Passenger and freight steamer	1	459	6	Triweekly.
Schooners and sloops	Unknown.	1, 200	5 to 7	Grain, lumber, and fertilizers.

Fifty sailing vessels, of 700 tons aggregate tonnage, built and repaired during the year.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 16.

IMPROVEMENT OF WICOMICO RIVER, MARYLAND.

For previous history see Annual report of the Chief of Engineers for 1898, Part I, page 172.

The amount expended by the General Government for the improvement of this river to June 30, 1897, was $19,473.60.

No work has been done during the past year. The expenditures were for office expenses. The contract made with Chester T. Caler for dredging has been extended to December 31, 1898.

Wicomico River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

Money statement.

July 1, 1897, balance unexpended	$3, 726. 40
June 30, 1898, amount expended during fiscal year	128. 20
July 1, 1898, balance unexpended	3, 598. 20
July 1, 1898, amount covered by uncompleted contracts	3, 598. 20

AMOUNTS APPROPRIATED.

By act of—	
June 10, 1872	$5,000
March 3, 1873	5,000
June 28, 1874	5,000
March 3, 1875	5,000
August 14, 1876	5,000
June 18, 1878	5,000
March 3, 1879	3,000
June 14, 1880	5,000
March 3, 1881	2,000
July 5, 1884	10,000
Total	50,000
September 19, 1890	10,000
July 13, 1892	6,500
August 18, 1894	3,000
June 3, 1896	3,700
Total on present project	23,200
Aggregate	73,200

Contract in force with Chester T. Caler, dated December 24, 1896, approved January 5, 1897, for dredging certain rivers and harbors on eastern shore of Chesapeake Bay. Time for beginning work, January 15, 1897, and expiration, June 30, 1898. Time extended to December 31, 1898.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Bone, phosphate rock, oysters, etc	4,723	$55,736
Fertilizers, flour, dressed lumber, millwork, etc	75,531	633,722
Horses, cattle, grain, etc	968	30,158
General merchandise	5,257	210,000
Total	86,479	929,616
Shipments:		
Coal, wood, ship timber	15,450	25,465
Canned goods, fertilizers, machinery, etc	13,071	198,270
Corn, wheat, fruit, etc	3,523	164,378
General merchandise	28,750	1,150,000
Total	60,794	1,538,113
Total receipts and shipments	147,273	2,467,729

Vessels trading in Wicomico River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	704	5½	Triweekly.
Schooners	13	589	5 to 8½	Weekly.
Do	1	400	....	Occasionally.
Do	1	600	....	Monthly.

The above statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company and the Hon. E. Stanley Toadvin, of Salisbury, Md.

I 17.

IMPROVEMENT OF MANOKIN RIVER, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 172.

No work has been done on the improvement during the past fiscal year. The amount expended to June 30, 1897, is $18,975.

The river and harbor act of June 3, 1896, appropriated $4,000 for continuing the improvement, but directed that $2,000 of the appropriation should be expended in improving the river between Dashiells Creek and a point on the river known as the Red Bridge or County Wharf. After due advertisement a contract was made with Chester T. Caler, of Norfolk, Va., at 9½ cents per cubic yard, place measurement, for the dredging required. Under this contract it is proposed to widen the 60-foot cut at the "Flats" to 80 feet, and to redredge where the channel is found to have shoaled; and in the upper river to widen and deepen the channel to 50 feet and 6 feet, respectively, between Dashiells Creek and the steamboat wharf, as far as the available funds will permit, at both places.

It was impracticable to obtain commercial statistics.

Manokin River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

Money statement.

July 1, 1897, balance unexpended	$4,025.00
July 1, 1898, balance unexpended	4,025.00
July 1, 1898, amount covered by uncompleted contracts	4,025.00
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	4,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNTS APPROPRIATED.

By act approved—	
September 19, 1890	$7,500
July 13, 1892	7,500
Act of August 18, 1894	4,000
Act of June 3, 1896	*4,000
Total	23,000

Contract in force with Chester T. Caler, dated December 24, 1896, approved January 5, 1897, for dredging certain rivers and harbors on eastern shore of Chesapeake Bay. Time for beginning work January 15, 1897, and expiration June 30, 1898. Time extended to December 31, 1898.

I 18.

IMPROVEMENT OF POCOMOKE RIVER, MARYLAND, BELOW SNOW HILL.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 173.

The amount expended on this improvement to June 30, 1897, was $24,987.26, of which $4,487.26 was on the present project.

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* Of this amount, $2,000 is for work in the upper river not covered by the project.

No work has been done on the improvement during the past fiscal year.

It is proposed to expend the amount asked for, if appropriated, in dredging the channel to the full width and depth in accordance with the project.

Pocomoke River is in the collection district of the eastern district of Maryland. Crisfield is the nearest port of entry. As no dutiable articles are discharged there, no revenue was collected during the fiscal year.

Money statement.

July 1, 1897, balance unexpended	$512.74
July 1, 1898, balance unexpended	512.74
July 1, 1898, outstanding liabilities	373.63
July 1, 1898, balance available	139.11
Amount (estimated) required for completion of existing project	9,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	4,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

By act approved—	
June 18, 1878	$10,000
March 3, 1879	2,500
August 5, 1886	8,000
Total	20,500
By act of June 3, 1896	5,000
Aggregate	25,500

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Coal, dimension stone, ice, etc	1,228	$6,990
Fertilizers, flour, millwork, etc	2,878	76,254
Cattle, hogs, hay, etc	593	19,240
General merchandise	1,455	58,200
Total	6,154	160,684
Shipments:		
Cord wood, logs, ship timber, etc	2,303	27,795
Canned goods, crates, lumber, etc	18,061	298,080
Fruit, grain, eggs, etc	5,210	122,432
Total	25,574	448,307
Total receipts and shipments	31,728	608,991

Vessels trading in Pocomoke River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Passenger and freight steamers	1	654	6.5	Semiweekly.
Schooners and sloops	Unknown.	6,610	5 to 7	Grain, lumber, fertilizers.

Ninety sailing vessels, schooners, sloops, barges, and bugeyes, of a tonnage of 4,600, built and repaired during the year.

The statistics were furnished by the Baltimore, Chesapeake and Atlantic Railway Company.

I 19.

IMPROVEMENT OF QUEENSTOWN HARBOR, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 174.

The amount expended on this improvement to June 30, 1897, was $17,288.73, of which $14,000 was on previous projects.

No work has been done during the past year.

Queenstown is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1898, is $1,780,253.99.

Money statement.

July 1, 1897, balance unexpended	$1,711.27
June 30, 1898, amount expended during fiscal year	473.75
July 1, 1898, balance unexpended	1,237.52
July 1, 1898, outstanding liabilities	200.00
July 1, 1898, balance available	1,037.52

AMOUNTS APPROPRIATED.

By act approved—	
March 3, 1871	$5,000
June 10, 1872	6,000
March 3, 1879	3,000
Total	14,000
By act of June 3, 1896	5,000
Aggregate	19,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897.

Traffic.

Per Chester River Steamboat Company, freight	tons	3,857
Per Queen Anne's Railroad Company, freight	do	10,838
Per Queen Anne's Railroad Company, passengers		30,703

The service of the Queen Anne's Railroad Company was performed by the steamer *B. S. Ford* and embraces only the period from April 8 to December 31, 1897.

Vessels trading in Queenstown Harbor, Maryland.

The Chester River Steamboat Company's steamer *Emma A. Ford*, 533 registered tonnage, makes daily trips five months in the year, and then triweekly. The Queen Anne's Railroad steamer *B. S. Ford* has a registered tonnage of 417 tons.

I 20.

IMPROVEMENT OF ROCKHALL HARBOR AND INNER HARBOR AT ROCKHALL, MARYLAND.

For previous history see Annual Report of the Chief of Engineers for 1898, Part I, page 174.

The amount expended on this improvement to June 30, 1897, was $699.10.

At the beginning of the fiscal year 1898 operations were in progress in both sections and were continued, with some interruption during the winter, to June 14, 1898. During this time the channel across Swan Point bar was carried to the 10-foot depth in Chesapeake Bay, removing 69,260 cubic yards of material, and in the inner harbor the channel was carried to the old pier at Rockhall and a turning basin, embracing both the old and new piers, was made at the latter place, removing 48,079 cubic yards of material. The dredged material consisted largely of hard sand and clay, and was deposited in shoal water on the west side under Swan Point bar, below Huntingfield Point, except a small quantity at the new pier, which was thrown over back of the bulkhead. The length of the outer cut is 4,600 feet and the width 80 feet, and the width of the inner cut is 100 feet. This completes the project.

The operations have resulted in a continuous 10-foot mean low-water navigation from Rockhall to Cheaspeake Bay, shortening the distance to Baltimore considerably.

Rockhall is in the collection district of Baltimore, which is the nearest port of entry. The amount of revenue collected there during the fiscal year ending June 30, 1898, is $1,780,253.99.

Money statement.

July 1, 1897, balance unexpended	$15, 900. 90
June 30, 1898, amount expended during fiscal year	14, 752. 28
July 1, 1898, balance unexpended	1, 148. 62
July 1, 1898, outstanding liabilities	1, 148. 62

AMOUNT APPROPRIATED.

By act of June 3, 1896	$16, 600

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1897

Receipts and shipments.

Class.	Tons.	Value.
Receipts:		
Flour, lumber, shingles, etc	1, 124	$16, 600
General merchandise	4, 180	167, 200
Total	5, 304	183, 800
Shipments:		
Corn, wheat, oats, etc	5, 630	104, 500
General merchandise	2, 280	91, 200
Total	7, 910	195, 700
Total receipts and shipments	13, 214	379, 500

Vessels trading at Rockhall, Md.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			Feet.	
Steamer	1	215	7½	Daily, except Sunday, about 10 months; then triweekly.
Schooners, sloops, and bugeyes	19	862	5½ to 7½	Semiweekly.
Bugeye	1	6	3½	
Total	21	1,083		

The above statistics were furnished by Mr. George Warfield, president Chester River Steamboat Company, as to the traffic of that company; the remainder by Mr. John R. Beckett, inspector, Engineer Department.

I 21.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of steamboat Delaware.—This was reported on August 31, 1897, by the Wilmington and Northern Railroad Company. The vessel was formerly called the *Perry*, and was a side-wheel steamer, 152 feet long, 25 feet beam, and 7½ feet draft. Upon examination it was found sunk in the Christiana River just above the Baltimore and Ohio Railroad drawbridge, about 60 feet off shore, with a foot of water above the deck at mean low water. The wreck in its position endangered navigation, and its removal having been authorized and an allotment of $750 made therefor, a contract was made, after due advertisement, with Frank C. Arthur, of Philadelphia, the lowest bidder, for its removal, at $385. The work of removal was begun on November 12 and completed on December 6, 1897. The wreck was broken up by blasting with dynamite, and the débris placed on shore, above high water. The entire cost was $533.46.

Wreck of schooner Del May.—This was reported November 13, 1897. Upon examination it was found to be an oyster boat lying sunk in 12 feet of water 2¾ miles southeast of Solomons Lump Light and 2 miles southeast of Holland Island Bar Light, in Chesapeake Bay, Maryland. This placed her in an almost direct course between the two lighthouses, and in the channel used by steamers and sailing craft. The removal of the wreck having been authorized and an allotment of $1,100 made therefor, contract was entered into, after advertisement, with Frank C. Arthur, of Philadelphia, at $850. This was the lowest bid in proper form, one lower, that of Louis E. Broom, of Baltimore, at $700, being defective. The work of removing the wreck was begun January 25 and completed February 7, 1898. The wreck was blown up with dynamite, and the débris removed and placed above high water, a part of it at Crisfield, Md., and the remainder at Norfolk, Va. The entire cost was $991.77.

Wreck of scow sunk at Rothwells Landing, in Smyrna River, Delaware.—This was reported in September, 1897. The scow was part of a dredging contractor's plant, and was left on the river when he failed. It was originally fastened to the bank, but slipped away into the channel and sank, obstructing navigation. Its removal having been authorized and an allotment of $150 made therefor, work thereon was begun June 29, 1898, and at the close of the fiscal year was still in progress.

Wrecks of barges J. E. Gillingham and William E. Weller.—It was reported to me in March, 1898, by the collector of customs at Baltimore, that there were three submerged wrecks at the mouth of the Elk River, Maryland, which were endangering navigation. Upon examination, one of them, the *J. E. Gillingham*, was found. This was wrecked about December 24, 1897, loaded with gas coal, and sunk about 2 miles southeast from Turkey Point, directly in the channel of the river, and dangerous to navigation. A wrecking schooner was engaged at the time of the examination in removing the cargo of coal. The barge was about 100 feet long and 20 feet beam, and was lying in 21 feet of water, with 9 feet of water over her deck. No other wrecks could be found. The removal of the *Gillingham* having been authorized and an allotment of $1,200 made therefor, a contract was made, after due advertisement, with Charles W. Johnston, of Philadelphia, the lowest bidder, at $745. Work thereon was begun on June 30, 1898, and at the close of the fiscal year operations were still in progress. Upon a further search, later, for the other two wrecks reported, the wreck of another barge, believed to be the *William E. Weller*, was found lying in 12 feet of water, considerably settled in the mud, about 1 mile from Turkey Point, on a line with the Turkey Point light-house and the outer end of Howells Point. The removal of the wreck has been authorized, but work thereon is suspended for the present by direction of the Secretary of War. It has been buoyed, and its bearings from near-by points are from Turkey Point light-house ENE., from Locust Point light-house SSW., and from Grove Point light-house NW. ½ W.

Abstract of proposals received by Gen. William F. Smith, United States agent, and opened November 1, 1897, for removing wreck of steamboat Delaware, in Christiana River, Delaware.

No.	Name and address of bidder.	Time to— Commence.	Time to— Complete.	Price.
		Days.	*Days.*	
1	Chas. Smedley, New York	10	40	$2,500
2	F. C. Arthur, Philadelphia, Pa. [a]	10	30	385
3	Atlas Dredging Co., Wilmington, Del	10	30	575
4	John L. Mills, Camden, N. J	3	30	797
5	John C. Ross, Lewes, Del	10	30	741
6	Chas. W. Johnston, Philadelphia, Pa	10	60	850
7	John J. Williams, South Chester, Pa	10	10	618

[a] Contract made with F. C. Arthur.

Abstract of proposals received by Gen. William F. Smith, United States agent, and opened January 3, 1898, for removal of wreck of schooner Del May, in Chesapeake Bay, Maryland.

No.	Name and address of bidder.	Time to— Commence.	Time to— Complete.	Amount.	Remarks.
			Days.		
1	Frank C. Arthur, Philadelphia, Pa. [a]	10 days after notification.	30	$850	
2	Louis E. Broom, Baltimore, Md	do	30	700	Defective—no guaranty, etc.
3	Henry Seymour, Norfolk, Va	do	30	2,000	
4	J. T. Gibbs, for Wm. H. French, Norfolk, Va.	do	30	1,400	

[a] Contract made with Frank C. Arthur.

Abstract of proposals received by Gen. William F. Smith, United States agent, and opened June 7, 1898, for removal of wreck of barge J. E. Gillingham, at mouth of Elk River, Maryland.

No.	Name and address of bidder.	Time to— Commence.	Time to— Complete.	Amount.
		Days.	*Days.*	
1	Lewis E. Broom, Baltimore, Md	10	30	$800
2	Charles W. Johnston, Philadelphia, Pa.[a]	10	30	745
3	John C. Ross, Lewes, Del	10	30	995

[a] Contract made with Charles W. Johnston.

APPENDIX J.

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, BRIG. GEN. PETER C. HAINS, UNITED STATES VOLUNTEERS, COLONEL, CORPS OF ENGINEERS, AND LIEUT. CHARLES W. KUTZ, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Patapsco River and channel to Baltimore, Maryland.
2. Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.
3. Harbor of Southwest Baltimore (Spring Garden), Maryland.
4. Removing sunken vessels or craft obstructing or endangering navigation.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., July 19, 1898.

GENERAL: I have the honor to forward herewith the annual reports for the year ending June 30, 1898, for the works of improvement of rivers and harbors in my charge.

Very respectfully, your obedient servant,

CHARLES W. KUTZ,
Second Lieut., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF PATAPSCO RIVER AND CHANNEL TO BALTIMORE, MARYLAND.

The work of the fiscal year has been confined to dredging operations under the existing project for increasing the depth of the channel from 27 feet at mean low water to 30 feet at mean low water, with a bottom width of 600 feet and a much greater width in the bends.

Four hundred thousand dollars was appropriated by the act of June 3, 1896, and $50,000 more by the same act for the maintenance of the 27-foot channel. With these funds a cut 30 feet deep at mean low water has been made in the middle of the existing channel from the deep water of the Chesapeake Bay to Fort McHenry. The cut is 230 feet wide in the Fort McHenry, Brewerton, and Craighill divisions, and 250 feet wide in the Cut-off division, with extreme width in the angles and entrances varying from 700 feet to 1,000 feet. The length of the new channel is about 18 miles, and in that distance 4,694,290 cubic yards of material have been removed and redeposited not less than 1 mile east of the Craighill Channel and not less than 1 mile south of the Brewerton Channel range.

The area dredged was 3,195,910 square yards, making an average removal of 1.47 cubic yards of material (scow measurement) per square yard of area.

The work has been done by contract with the Virginia Dredging Company, at 7.99 cents per cubic yard for excavation and redeposit. The plant consisted of four dredges of the clam-shell type, and one carrying an endless chain of buckets, together with the necessary number of steam tenders and a scant complement of scows. The contract was commenced December 8, 1896, and by working night and day a portion of the time was completed promptly upon its expiration, June 30, 1898.

The powerful bucket dredge *Kennedy* was found to be well adapted for the removal of the hard material in portions of the Cut-off and Fort McHenry channels. Her capacity in this hard material was dwarfed by the want of sufficient scows to receive her output. Much of the time she was idle from this cause. A portion of the material in the Cut-off Channel is a very hard brick clay, and this was readily ripped up and disposed of by the *Kennedy*. This dredge worked equally well in the gravel and iron-ore shale to be found at the upper end of the Fort McHenry Channel.

The United States steam tenders *Runaway* and *Sentinel* have been used a part of the time in the inspection of the work under the contract, both these steamers being in commission for all the works of river and harbor improvement and fortifications in the vicinity of Baltimore.

Money statement.

July 1, 1897, balance unexpended	$382, 726. 77
June 30, 1898, amount expended during fiscal year	312, 586. 05
July 1, 1898, balance unexpended	70, 140. 72
July 1, 1898, outstanding liabilities	49, 054. 38
July 1, 1898, balance available	21, 086. 34
Amount (estimated) required for completion of existing project	2, 100, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	800, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

The following are the amounts and dates of appropriations for improving harbor at Baltimore, Md., including Patapsco River:

August 30, 1852	$20, 000	March 3, 1879	$160, 000
August 15, 1856	100, 000	June 14, 1880	100, 000
June 28, 1864	20, 000	March 3, 1881	150, 000
June 23, 1866	5, 200	August 2, 1882	450, 000
March 3, 1867	75, 000	July 5, 1884	250, 000
July 25, 1868	17, 000	August 5, 1886	150, 000
April 10, 1869	26, 730	August 11, 1888	300, 000
July 11, 1870	42, 900	September 19, 1890	340, 000
March 3, 1871	50, 000	March 3, 1891	151, 200
June 10, 1872	100, 000	August 5, 1892	208, 000
March 3, 1873	200, 000	August 18, 1894	50, 000
June 23, 1874	75, 000	June 3, 1896	400, 000
March 3, 1875	75, 000	June 3, 1896	50, 000
August 14, 1876	75, 000		
June 18, 1878	75, 000	Total	3, 716, 030

The following contracts were in force during the fiscal year: With the Virginia Dredging Company, for dredging, approved December 11, 1896—commenced December 8, 1896, and completed June 30, 1898; with R. M. Spedden Company, for building a steam vessel, approved March 10. 1897—commenced in February, 1897, and completed July 9, 1897.

COMMERCIAL STATISTICS.

Commercial statistics of the port of Baltimore, Md., comparing the fiscal years ending June 30, 1897 and 1898.

[Compiled for the use of Lieut. Charles W. Kutz, Corps of Engineers.]

IMPORTS.

	Free.	Dutiable.	Total.
1897	$5, 856, 446. 38	$5, 514, 352. 87	$11, 370, 799. 25
1898	5, 036, 777. 00	3, 868, 426. 00	8, 905, 203. 00
Decrease in 1898	819, 669. 38	1, 645, 926. 87	2, 465, 596. 25

In American vessels in 1898:	
Sailing	$1, 725, 385
Steam	189, 169
In foreign vessels in 1898:	
Sailing	392, 383
Steam	6, 591, 059
In cars overland	7, 207
Total	8, 905, 203

DOMESTIC EXPORTS IN 1898.

	Sailing.	Steam.	Total.
In American vessels	$1, 259, 935	$92, 569	$1, 352, 504
In foreign vessels	124, 118	117, 305, 550	117, 429, 668
Total			118, 782, 172
Total in 1897			85, 670, 912
Increase in 1898			33, 111, 260

Articles exported.

	Tons.		Tons.
Cattle	41, 468	Vegetable oils	8, 793
Corn	1, 206, 255	Canned beef	3, 877
Oatmeal	7, 995	Fresh beef	4, 850
Wheat	578, 086	Salt beef	1, 240
Flour	236, 741	Tallow	4, 258
Coal	98, 853	Bacon	31, 949
Copper, ingots, etc	42, 586	Hams	3, 427
Cotton (unmanufactured)	47, 829	Salt pork	6, 789
Dried apples	2, 478	Lard	59, 059
Grape sugar	14, 799	Oleomargarine	19, 473
Pig iron	10, 477	Starch	7, 210
Iron, and manufactures of	87, 587	Leaf tobacco	34, 638
Oil cake	66, 866	Tobacco stems	1, 942
Paraffin wax	3, 481	Rosin	5, 821
Mineral oils	116, 119	Wood, and manufactures of	218, 492

Transportation in bond, with appraisement, from July 1, 1897, to July 1, 1898.

	Value.	Estimated duty.		Value.	Estimated duty.
Chicago	$923	$880. 46	Indianapolis	$98, 191	$84, 415. 00
Cincinnati	240	313. 61	Kansas City	11, 593	10. 109. 00
Cleveland	2, 946	866. 29	Louisville	145, 751	398, 845. 90
New York	3, 287	3, 930. 62	Los Angeles	647	388. 20
Omaha	1, 981	1, 804. 56	Milwaukee	18, 092	17, 014. 80
Peoria	10, 943	6, 380. 35	Minneapolis	6, 199	3, 719. 40
Philadelphia	19, 333	8, 289. 69	Norfolk	95	42. 75
Syracuse	561	888. 00	New York	3, 611	7, 222. 00
Sioux City	290	289. 52	Omaha	752	2, 250. 00
Wheeling	1, 012	920. 48	Pittsburg	18, 466	17, 915. 70
Buffalo	1, 247	773. 75	Philadelphia	142, 174	223, 110. 50
Chicago	598, 045	603, 223. 35	Richmond	467	280. 20
Cincinnati	113, 702	190, 338. 10	St. Louis	579, 080	494, 446. 97
Cleveland	133, 390	82, 233. 70	St. Paul	15, 045	14, 553. 80
Columbus	2, 951	3, 190. 10	Savannah	601	1, 112. 00
Detroit	38, 223	33, 788. 90	San Francisco	2, 099	6, 300. 00
Denver	100	200. 00	St. Joseph	1, 622	1, 173. 20
Dubuque	1, 824	1, 094. 40	Toledo	13, 376	19, 554. 90
Des Moines	253	151. 80	Washington	9, 733	14, 625. 70
Evansville	579	347. 40	Wilmington, Del	464	377. 50
Erie	1, 217	1, 217. 00			
Grand Rapids	10, 461	12, 278. 40	Total	1, 970, 050	2, 251, 294. 42

Summary of merchandise transported in bond.

	Value.	Bond.
1897	$2, 268, 390	$2, 307, 488. 66
1898	1, 970, 050	2, 251, 294. 42
Decrease in 1898	298, 340	56, 194. 24

Amount of duties collected in 1898	$1, 677, 922. 73
Miscellaneous customs receipts in 1898	102, 331. 26
Total receipts in 1898	1, 780, 253. 99
Total receipts in 1897	2, 361, 264. 39
Decrease in 1898	581, 010. 40
Duties on merchandise in bond in 1898	213, 654. 68
Duties on merchandise in bond in 1897	198, 444. 92
Increase in 1898	15, 209. 76

Summary of duties collected in 1898.

Imports and miscellaneous customs receipts	$1, 780, 253. 99
Merchandise in bond	213, 654. 68
Merchandise transported with appraisement	24, 563. 58
Total	2, 018, 472. 25

Statistical recapitulation.

Dutiable imports have decreased	$1, 645, 926. 87
Free imports have decreased	$819, 669. 38
Domestic exports have increased	$33, 111, 260. 00
Tonnage, foreign and coastwise, has increased ... tons	592, 811. 00
Decrease in duties collected	$605, 414. 25
Increase in duties on merchandise in bond	$15, 209. 76
Decrease in duties on merchandise in bond (with and without appraisement)	$116, 020. 76

Tonnage movement.

Vessels.	Entered.		Cleared.	
	1896–97.	1897–98.	1896–97.	1897–98.
American:				
Sail	48,001	38,394	50,863	45,763
Steam	21,823	13,072	17,375	13,393
Foreign:				
Sail	15,752	15,704	3,445	7,422
Steam	1,167,832	1,587,191	1,447,714	1,758,392
Total	1,253,408	1,654,361	1,519,397	1,824,970

	Foreign.		Coastwise.	
	1896–97.	1897–98.	1896–97.	1897–98.
Inward	1,253,408	1,654,361	1,947,198	1,843,764
Outward	1,519,397	1,824,970	2,147,213	2,126,932

	Vessels.	Tons.
Vessels entered, 1898	1,043	1,654,361
Vessels, cleared, 1898	1,099	1,824,970
Total foreign:		
1898	1,881	3,368,709
1897	1,454	2,634,743
Vessels entered coastwise:		
1898	1,521	1,843,764
1897	2,107	2,126,932
Total coastwise:		
1898	3,628	3,970,696
1897	3,760	4,094,411
Total foreign tonnage in and out:		
1898	1,881	3.368,709
1897	1,454	2,634,743
Total tonnage		
1898	2,142	3,479,331
1897	1,757	2,772,805

Vessels built.

	No.	Gross tonnage.	Net tonnage.
Steam	15	1,810.21	1,213.01
Sail	19	523.23	508.64
Total	34	2,333.44	1,721.65

Number of immigrant passengers arrived.

	Male.	Female.	Total.
1897–98	6,399	4,641	11,040
1896–97	3,502	2,908	6,410

Established lines of steamships.

	No.	Tons.	Destination.
Johnson Line	9	30,700	Liverpool.
Atlantic Transport Line	9	20,194	London.
North German Lloyd	16	51,291	Bremen.
Blue Cross Line	3	6,896	Havre.
Buckman Line	5	2,211	Jamaica.
Neptune Line	8	15,586	Rotterdam.
Donaldson Line	8	19,577	Glasgow.
Lord Line	10	20,406	Belfast and Dublin.
Puritan Line	4	8,660	Antwerp.
Monumental Trading Co	2	799	Jamaica.
Hamburg-American Line	26	67,203	Hamburg.
Empire Line	4	6,376	Leith.
	104	249,899	

The following lines have been added to the number of vessels heretofore reported:

	Vessels.		Vessels.
Hamburg-American Line	1	Atlantic Transport Line	1
North German Lloyd	3	Neptune Line	1
Donaldson Line	1	Lord Line	3.

The following lines have been discontinued:

	Vessels.		Vessels.
Empire Line, to Leith	8	Hammonia Line, to Brazil	7
Earn Line, to Santiago, Cuba	9	Lamport & Holt, to Brazil	13

The tonnage movement at this port for the fiscal year ended June 30, 1898, shows an increase of 26 per cent over that of the preceding year. The increase would doubtless have been much greater but for the war with Spain, which has had the effect of making the tonnage movement toward the Tropics timid and uncertain, the trade with Spanish ports being entirely suspended. The large movement of grain and breadstuffs, unprecedented in its history, is a matter of congratulation, showing this to be a favored port for the outlet of the grain fields of the West and Northwest. While the maintenance of railroad and load-line differentials is unquestionably of great advantage, yet without the other superior advantage of cheap port charges, quick dispatch, and enterprising, alert business men, Baltimore would not be able to take the lead of her less-favored sister cities of the Atlantic seaboard.

There are now 12 established lines of foreign steamships trading at this port, representing 104 vessels, having an aggregate carrying capacity of over 400,000 tons.

William F. Stone, *Collector.*

Lieut. **Charles W. Kutz**,
Corps of Engineers.

J 2.

IMPROVEMENT OF CHANNEL TO CURTIS BAY, IN PATAPSCO RIVER, BALTIMORE HARBOR, MARYLAND.

The river and harbor act of 1892 contained the following item:

> Improving Patapsco River, Baltimore Harbor, Maryland: For dredging a channel one hundred and fifty feet wide at bottom and of a depth of twenty-seven feet mean low water from the main ship channel to Curtis Bay, in accordance with recommendation of Col. William P. Craighill, Corps of Engineers, submitted December thirteenth, eighteen hundred and ninety, twenty-eight thousand dollars.

The total estimated cost of the improvement was $85,000. The above appropriation was expended in dredging, by contract, a channel 150 feet wide to a depth of 25 feet at mean low water, which was completed in May, 1893.

An appropriation of $12,000 was made August 18, 1894, but the channel already dredged answers all present needs, and it has been decided to hold the new appropriation until its expenditure is required.

Money statement.

July 1, 1897, balance unexpended	$12,000.00
July 1, 1898, balance unexpended	12,000.00
Amount (estimated) required for completion of existing project	45,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

The following are the amounts and dates of appropriations for improving channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland:

July 13, 1892	$28,000
August 18, 1894	12,000
Total	40,000

J 3.

IMPROVEMENT OF HARBOR OF SOUTHWEST BALTIMORE (SPRING GARDEN), MARYLAND.

The river and harbor act of June 3, 1896, contained the following item:

> Improving harbor of Southwest Baltimore (Spring Garden), Maryland, in accordance with report submitted March seventh, eighteen hundred and ninety-six, for constructing channel one hundred feet wide on the bottom, five thousand dollars.

The report referred to in the act is to be found printed in House Doc. No. 304, Fifty-fourth Congress, first session, and on pages 1006–1007, Annual Report of the Chief of Engineers for the fiscal year ending June 30, 1896.

The total estimated cost of the improvement was $314,000.

There were no operations in the year ending June 30, 1898.

Money statement.

Amount appropriated by act of June 3, 1896	$5,000.00
July 1, 1898, balance unexpended	5,000.00
Amount (estimated) required for completion of existing project	309,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	100,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following is the amount and date of appropriation for improving harbor of Southwest Baltimore (Spring Garden), Maryland:

June 3, 1896	$5,000

J 4.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Schooners Three Brothers and Fleming.—The wreck of the *Three Brothers* lay in 32 feet of water in the Cut-off division of the ship channel leading to the port of Baltimore, 7,000 feet south of Seven Foot Knoll Light and about 100 feet east of the center line of the channel.

On November 16 three charges of 75 per cent dynamite were placed by means of a submarine diver and exploded by a blasting battery.

The wreck was completely shattered, but as it lay almost in the center of the channel it was deemed advisable to remove all the débris. This was done several days later by a clam-shell dredge working in the vicinity of the wreck.

The *Fleming* lay in 20 feet of water, three-eighths of a mile west of the Craighill division of the ship channel leading to Baltimore and 2½ miles north of its mouth.

This wreck was blown up November 18 in a similar manner, except that the charges were placed from the surface, owing to the less depth of water.

After the explosion a few ribs were found projecting above the bottom with a least depth of 17 feet over them, but as no vessels drawing anything like 17 feet use this portion of the bay the wreck is no longer an obstruction to navigation. The removal of the débris was therefore not regarded as necessary.

Two hundred and fifty pounds of dynamite were used on the two wrecks.

The work was done during parts of three different days by the chief inspector of dredging (salary $100 per month) and the crew of the steam tug *Sentinel*, whose pay amounts to $350 per month.

The services of the boat were not charged in the account, because she was not materially diverted from her usual duties and there was no detriment to the works upon which she is engaged. The services of the chief inspector of dredging were not charged, for the same reason.

The actual cost of the work was as follows:

250 pounds dynamite, at 18 cents per pound	$45.00
Exploding battery	25.00
Wires, fuses, etc	14.92
Marline and twine	1.95
Submarine diver, with three assistants and use of apparatus, 1 day, at $35 per day	35.00
Use of dredge, lifting débris of *Three Brothers* after explosion, for the job	35.00
Total for removing two wrecks	156.87

APPENDIX K.

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES, OF JAMES RIVER, VIRGINIA, AND OF CERTAIN RIVERS IN VIRGINIA ON WESTERN SHORE OF CHESAPEAKE BAY.—PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

REPORT OF LIEUT. COL. CHAS. J. ALLEN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Potomac River at Washington, District of Columbia.
2. Occoquan Creek, Virginia.
3. Aquia Creek, Virginia.
4. Nomini Creek, Virginia.
5. Lower Machodoc Creek, Virginia.
6. Rappahannock River, Virginia.
7. Urbana Creek, Virginia.
8. York River, Virginia.
9. Mattaponi River, Virginia.
10. Pamunkey River, Virginia.
11. James River, Virginia.
12. Protection of Jamestown Island, Virginia.
13. Removing sunken vessels or craft obstructing or endangering navigation.

United States Engineer Office,
Washington, D. C., August 3, 1898.

General: I have the honor to forward herewith my annual report for the year ending June 30, 1898, on river and harbor works in my charge. * * *

Very respectfully, your obedient servant,

Chas. J. Allen,
Lieut. Col., Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

K 1.

IMPROVEMENT OF POTOMAC RIVER AT WASHINGTON, DISTRICT OF COLUMBIA.

PRESENT PROJECT.

The present project for improvement was adopted by act of Congress of August 2, 1882. It has for its objects the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the freeing of the Washington Channel, so far as it can be done, of sewage, and the establishment of harbor lines beyond which no wharves shall be built. The channels are to be made 20 feet deep at low water; the flats above Long Bridge to be filled in to a height of 3 feet above the flood plane of 1877, and below the bridge to be filled in to the same elevation along the middle longitudinal line, but to slope toward each channel so as to have a height of 6 feet above low tide at the margins of the fill. A tidal reservoir or basin was to be established above Long Bridge not less than 8 feet deep and provided with inlet and outlet gates automatically arranged for filling the reservoir on the flood tide from the Virginia Channel and emptying it into the Washington Channel to low-water level at the ebb. The project also considered the rebuilding of Long Bridge and the interception of sewage discharged into the Washington Channel and its conveyance to the James Creek Sewer Canal, but neither of these was included in the estimated cost of the improvement, which was $2,716,365. This estimate, as revised in 1897, was increased to $2,953,020, the reasons for which are stated in Appendix J to the Annual Report of the Chief of Engineers for 1897.

A training dike on the Virginia shore was added in 1890.

The first appropriation for improvement of the Potomac River in accordance with the report and recommendations of the Board of Engineers was by act of Congress of August 2, 1882, and is as follows:

> Improving Potomac River in the vicinity of Washington with reference to the improvement of navigation, the establishment of harbor lines, and the raising of the flats, under the direction of the Secretary of War and in accordance with the plan and report made in compliance with the river and harbor act approved March third, eighteen hundred and eighty-one, and the reports of the Board of Engineers made in compliance with the resolution of the Senate of December thirteenth, eighteen hundred and eighty-one, four hundred thousand dollars.
>
> And it is hereby made the duty of the Attorney-General to examine all claims of the title to the premises to be improved under this appropriation and see that the rights of the Government in all respects are secured and protected; and if he deems it necessary he is authorized to cause a suit or suits in law or in equity to be instituted, in the name of the United States, in the supreme court of the District of Columbia against any and all claimants of title under any patent which, in his opinion, was by mistake or was improperly or illegally issued for any part of the marshes or flats within the limits of the proposed improvement.

In December, 1869, a patent had been issued to John L. Kidwell for certain land in the Potomac River, which land is the so-called "Kidwells Meadows." The second clause in the appropriation for this improvement was to apply to this and all similar claims.

The river and harbor act of July 5, 1884, contained no proviso, but that of August 5, 1886, contained the following:

> *Provided,* That no part of the sum hereby appropriated shall be expended upon or with reference to any place in respect of which the title of the United States is in doubt, or in respect to which any claim adverse to the United States has been made.

Congress by another act, August 5, 1886, also provided that the Attorney-General of the United States should institute, as soon as might be, in the supreme court of the District of Columbia a suit against all persons and corporations who might have or pretend to have any right, title, claim, or interest in any part of the land or water in the District of Columbia within the limits of the city of Washington, or exterior to said limits and its front thereof, toward the channel of the Potomac River, and composing any part of the land or water affected by the improvement of the Potomac River or its flats, in charge of the Secretary of War, for the purpose of reestablishing and making clear the right of the United States thereto.

The act provided that the suit should be in the nature of a bill in equity. The act also allowed an appeal from the final decree of the supreme court of the District of Columbia to the Supreme Court of the United States; and also required that, until final decision should have been had, no moneys appropriated for the improvement of the Potomac River within the District of Columbia, the establishment of harbor lines in the District of Columbia, and the raising of the flats therein should be expended otherwise than upon property in respect of which there was no claim adverse to the title of the United States or for the improvement of navigation in the said river.

In accordance with the provisions of this act a bill of complaint and the answers were filed November 26, 1886, in the supreme court of the District of Columbia, holding a special term in equity.

After the date of the act just quoted the work of reclamation and filling was confined to that portion of the flats below the limits of the marsh known as "Kidwells Meadows," except when work was required for the improvement of navigation.

The case finally came up in the supreme court of the District of Columbia in general term April 22, 1895, the United States, by proceedings in equity, seeking to quiet the alleged title of about forty different claimants to land on the flats above the Long Bridge and to certain tracts of land along the river front from about Easbys Point to the Arsenal grounds.

On March 2, 1896, the court adjudged the value of the lots or parts of lots in squares 63, 89, 129, and 148 included within the limits of the improvement, the claims to which were allowed, and the sum of $26,684.09 was appropriated in the District of Columbia appropriation act of June 11, 1896, to be paid to the several claimants by the court.

The case, however, was taken, on appeal, to the Supreme Court of the United States. No decision has as yet been made, so far as known.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1898.

Dredging.—As stated in the last Annual Report, a contract was entered into March 9, 1897, with A. M. Clegg, of Washington, D. C., for dredging about 540,000 cubic yards of material from the Virginia Channel of the Potomac River. Of this amount 260,000 cubic yards, approximately, were to be dredged from the channel above Long Bridge and about 280,000 yards from the channel below the bridge, the dredged material to be deposited on Sections I, II, and III of the flats. The contract price was 10⅝ cents per cubic yard. The contract provided for commencement of the work on or before July 1, 1897, and completion of the same on or before October 1, 1898. That contemplated dredging and deposit of the spoil at the rate of 40,000 cubic yards per month.

On July 1, 1897, the date for commencing work, the dredge had not appeared on the work. On July 8 a letter was addressed to the contractor, calling his attention to that fact. He had already addressed a letter to this office requesting an extension of the time of commencement to October 15, 1897, but was informed that such extension could not be considered. Without detailing the communications to and from Mr. Clegg, who claimed that he had on hand other prior contracts, Mr. Clegg wrote, under date of July 27 and 28, that he expected to have a pumping dredge and other necessary outfit to commence work on the dredging of Potomac River on or about August 15, 1897, and that he had at his command ample plant and could finish the dredging long before the time limit of his contract.

This was reported to the Chief of Engineers August 5, 1897, and an extension of the time of commencement to about August 15, 1897, was recommended, this extension not to affect the date set in the contract for the completion of the work of dredging. This recommendation was approved by the Chief of Engineers.

On August 23, the dredge not having arrived, the contractor's attention was called to the fact.

During the same month the contractor sent piles and range stakes to the work and made preliminary arrangements for commencing the clearing of the ground where the material was to be deposited and for forming the embankments to hold and retain the dredge spoil. In September a force of men was employed in forming embankments on Section I. This work was continued during October and November. On October 20, 1897, the pontoons and pipe belonging to the dredge arrived at the work. The dredge left New York for Washington on October 16, 1897, but was driven ashore during a storm at or near Delaware Breakwater, as understood, on October 24. The dredge was hauled off and repaired and then towed to Washington, where it arrived November 16, 1897. Further repairs to the dredge were here found necessary.

In November the upper section of the channel above Long Bridge was staked out and piles were driven to mark the lines for dredging.

The following details are from a report by the assistant engineer engaged upon the work on the part of the Government.

> The repairs to the dredge were continued until December 21, 1897, on which date dredging operations were commenced in the Virginia Channel at the upper end of the bar. During the remainder of December 3,433 cubic yards of material were dredged. On December 27, 1897, the river was frozen over, causing some delay in the work of dredging, but not seriously obstructing navigation. The ice was broken up in the channel on January 5, 1898, so that dredging was resumed, and on January 11 the river was entirely clear. During this month 9,121 cubic yards of material were dredged. The weather was for the most part unusually favorable for the season, but the dredge was in such bad condition that but little progress was made. It was run 194 engine hours during January, and the average amount dredged per engine hour was but 48 cubic yards, an amount far below the requirements of the work. On February 1, 1898, the attention of the contractor was called by letter to the poor condition of the dredge and the machinery and appliances connected therewith and to the requirements of the contract and specifications in this regard.
>
> During the first part of February high winds, followed by cold weather and the formation of ice from 1 to 4 inches thick, rendered it impracticable to operate the dredge. After February 12, however, the weather was favorable. On that day the dredge was started, but ran only 1½ hours. On February 14 work was again resumed, but after a run of 2¾ hours a coupling on the cutter shaft broke, which was not repaired until February 21, when, on attempting to resume work, it was found impracticable to raise the spuds with the worn-out hoisting appliances. On the following day, February 22, the dredge was again started and run for 2¼ hours, when the coupling broke the second time, after which no apparent attempt was made that month to repair it. During February the dredge was run 6½ hours, but the amount of material dredged was so small that it was impracticable to estimate it. The experience of two months had shown the plant to be inefficient and without the capacity or power to do the work called for by the contract. The pump was small and badly worn, the boilers were leaky, the hoisting gear for raising and lowering the suction pipe and cutter was worn out, there were no adequate means of raising the spuds, and the rubber sleeves connecting the discharge pipes on the pontoons were nearly worn out.

Under date of February 21, 1898, the bondsmen on the contract were officially notified of the slow progress made by the contractor. On February 25 a special report was made to the Chief of Engineers upon the status of the work and the failure of the contractor to carry on the same in accordance with the provisions of the contract, and the annulment of the contract was recommended. This recommendation was approved by the Chief of Engineers, and on March 7, 1898, the contract was annulled in accordance with the terms of the said contract.

On March 17, 1898, an advertisement and new specifications for the dredging were submitted to the Chief of Engineers, with a view to readvertising the work.

On April 20, 1898, this office was informed by the Engineer Department that the annulment of Mr. Clegg's contract had been revoked by higher authority and that Mr. Clegg was to be permitted to proceed with the dredging of the Potomac River under his contract therefor, Mr. Clegg to execute a bond in the sum of $5,000 with an approved surety company for the completion of the work within the time specified in the contract, and to cover all losses which the United States might sustain on account of failure to perform said contract, said bond to be filed on or before April 25, 1898. This bond was filed.

Arrangements were at once made for laying out any additional lines of work, taking soundings, and inspecting and estimating any work which might be done by Mr. Clegg. Two assistant engineers from this office visited the dredge on April 21, but found that it was not in condition to work.

The assistant engineer further reports:

> On April 26 it was run for a trial of the machinery, and on the following day a spud was broken and work was not resumed that month. On May 2 and 3 the boilers were inspected, and on the last-named day the dredge was run for a part of a day. The dredge was at this time practically without coal. On the following day, May 4, the dredge was run for a few minutes, when the packing blew out of a pump and work was suspended. On May 5 the runner of the pump broke and was not repaired, nor was any work done during the remainder of the fiscal year.

The estimated total amount of dredging done by Mr. Clegg during the fiscal year was 12,554 cubic yards.

Sea wall.—On July 1, 1897, the work of reconstructing and raising the sea wall along the Washington Channel front of Section III, referred to in the last Annual Report, was in progress. This work was continued during the remainder of the working season. As the wall was completed gravel backing was placed behind it to afford efficient drainage and the earth filling banked up against the gravel. The laying of masonry was continued until November 12, 1897, when the limit of work proposed at that time was reached. The backing of the wall built during the season was completed November 30, 1897. The length of wall relaid and raised during the fiscal year ending June 30, 1898, was 2,780 feet.

AMOUNTS OF WORK DONE SINCE THE IMPROVEMENT WAS UNDERTAKEN.

The total number of cubic yards of material dredged from the channels from the commencement of the improvement (1882) to date and deposited on the flats is 10,693,554 cubic yards, and as follows:

For the fiscal year ended June 30—	Cubic yards.	For the fiscal year ended June 30—	Cubic yards.
1883	200, 000	1892	727, 700
1884	1, 115, 000	1893	156, 500
1885	1, 085, 000	1894	691, 100
1886	1, 832, 600	1895	524, 700
1887	1, 081, 500	1896	None.
1888	1, 192, 100	1897	12, 554
1889	1, 088, 300		
1890	704, 000	Total	10, 693, 554
1891	282, 500		

For convenience of designation and reference the reclaimed area has been divided into three sections, as follows:

Section I comprises the reclaimed area between Easbys Point and the sewer canal at the foot of Seventeenth street NW. Section II comprises the reclaimed area and the tidal reservoirs lying between the sewer canal and the Long Bridge. Section III comprises all of the reclaimed area below the Long Bridge lying between the Washington and Virginia channels.

AREAS.

Following is a summary of the areas of the several portions of the reclaimed area of the Potomac River improvement:

	Acres.
Total area (including reservoirs):	
Section I	134.81
Section II	277.08
Section III	327.53
Total area	739.42
Area of reservoirs:	
Large tidal reservoir	111.17
Small tidal reservoir	7.13
Total of reservoirs	118.30
Total area, as above	739.42
Deduct area of reservoirs	118.30
Total area of land	621.12

The total number of linear feet of sea wall built to date is 35,289, of which 4,910 linear feet have been taken down and relaid.

WORK REQUIRED TO COMPLETE THE PROJECT.

The items of work remaining to be completed are as follows: The dredging of the Virginia Channel and the raising of the remainder of the reclaimed area to the required height; the dredging of the tidal reservoir; the completion of the sea wall, the construction of the reservoir inlet, and the completion of the training dike on the right of the Virginia Channel above Long Bridge.

The sum of $225,000 can be profitably expended during the fiscal year ending June 30, 1900, toward completion of the project.

There are 500 linear feet of sea wall to be built on the northeast margin of the tidal reservoir when the bathing beach shall be discontinued.

The value of improvement of the Potomac can be appreciated by consulting the tables of commercial statistics appended to this report. Vessels of large draft, engaged in the coal trade, and which were formerly unable to cross the bar in the Virginia Channel, have been enabled, until within some months past, to arrive at and depart from the Georgetown wharves without appreciable trouble, and it is hoped that the early removal of the shoal places above Long Bridge will restore the 20-foot channel.

In the Washington Channel the increased depth has enabled deeper draft vessels engaged in the ice trade to reach the port, and freight rates are reported to have decreased, while increased width has greatly facilitated the management of steamers navigating the river. All of the coal shipped and most of the asphalt received pass through the Virginia Channel. The greater part of the ice received and all freights received by steamers come through the Washington Channel. Wood and ice, however, also go up the Anacostia River.

Maintenance.—The improvement has now reached a stage where the maintenance and preservation of the reservation require attention. The growth of weeds and underbrush, which, in the summer season especially, renders access to the various parts of the work difficult, should be cleared up each year until the reservation is ready to be laid out and graded. Annual repairs will also be needed on the wall and reservoir gates.

The proper police supervision of this extensive area of 621 acres has also become a matter of importance. In order to prevent infractions of the law, trespasses, etc., the reservation should be patrolled by mounted men, and it is recommended that annual provision be made for two watchmen. It is estimated that $5,000 will be required per annum for maintenance.

POTOMAC PARK.

Congress, by act of March 3, 1897, set aside the reclaimed flats for a public park in the following words:

> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the entire area formerly known as the Potomac Flats, and now being reclaimed, together with the tidal reservoirs, be, and the same are hereby, made and declared a public park, under the name of the Potomac Park, and to be forever held and used as a park for the recreation and pleasure of the people.

These flats are capable of being transformed into one of the finest parks in the country.

The present project for creation of the reclaimed area contemplates carrying the work (the fill from deposit of dredged material) to an elevation of 3 feet above the flood plane of 1877. The exceptionally high flood of 1889, however, exceeded that of 1877, at the site of the flats, by about 3 feet. If the raising of the flats be limited to the elevation contemplated in the present project, the river surface, in case of another flood equal to that of 1889, will stand at about the same level as the highest surface of the reclaimed flats. Although such floods seldom occur, and when they do occur are generally of short duration, the surface of the park should be high enough to secure its areas, drives, etc., against injury from any flood. It will probably meet requirements if the entire acreage of the reclaimed area be carried to an elevation of about 3 feet above the flood plane of 1889. Such increase, including the necessary strengthening and readjustment of sea wall and contingencies, would probably cost, according to present prices, about $1,000,000; this in addition to the cost of completing the reclamation of the flats under the present project.

In laying out the land for a park an adequate system of drainage has to be considered.

Washington is in the collection district of Georgetown, D. C. The nearest lighthouse is at Jones Point, Virginia.

Money statement.

July 1, 1897, balance unexpended	$122,506.16
June 30, 1898, amount expended during fiscal year	24,266.52
July 1, 1898, balance unexpended	98,239.64
July 1, 1898, outstanding liabilities	441.00
July 1, 1898, balance available	97,798.64
Amount (estimated) required for completion of existing project	668,020.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	225,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

August 2, 1882	$400,000	July 13, 1892	$200,000
July 5, 1884	500,000	August 18, 1894	150,000
August 5, 1886	375,000	June 3, 1896	100,000
August 11, 1888	300,000		
September 19, 1890	260,000	Total	2,285,000

CONTRACT IN FORCE.

A. M. Clegg, dredging, dated March 9, 1897; approved March 16, 1897; date of commencement, July 1, 1897; date of completion, October 1, 1898.

COMMERCIAL STATISTICS.

[Furnished by Mr. J. W. Averill, Washington, D. C.]

Receipts and shipments.

Calendar year—	Coal.	Ice.	Lumber.	Sand.	Wood.	Miscellaneous.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1887	264,947	120,237	37,044	50,000	52,419	94,325	618,972
1888	240,836	108,421	45,101	50,000	33,040	104,177	581,575
1889	92,511	115,506	41,407	75,000	35,351	128,905	488,680
1890	72,089	135,552	69,604	75,000	48,457	118,994	519,696
1891	114,913	123,107	50,106	60,000	48,457	154,636	551,219
1892	280,342	148,692	68,178	20,000	48,457	261,285	766,954
1893	333,837	143,837	33,167	18,000	48,457	76,135	653,433
1894	306,743	138,094	36,935	41,850	58,203	62,763	644,588
1895	291,268	135,158	51,327	39,284	49,930	127,483	693,450
1896	334,293	131,542	44,696	32,400	50,842	129,884	723,657
1897	260,328	106,406	38,694	25,500	29,250	63,320	523,498

Number of vessels of various classes arriving and departing.

Calendar year—	Steamers drawing from 5 to 15 feet, 100 to 600 tons.	Vessels drawing from 10 to 21 feet, 300 to 2,100 tons.	Vessels drawing from 4 to 10 feet, 30 to 300 tons.	Barges drawing from 5 to 12 feet, 100 to 600 tons.
1887	970	573	2,149	993
1888	710	525	1,588	2,821
1889	675	455	1,563	929
1890	696	491	1,572	286
1891	980	445	1,854	862
1892	1,065	466	2,046	527
1893	906	431	2,301	450
1894	1,118	455	2,388	323
1895	1,060	442	2,055	290
1896	955	527	2,367	325
1897	939	470	2,165	330

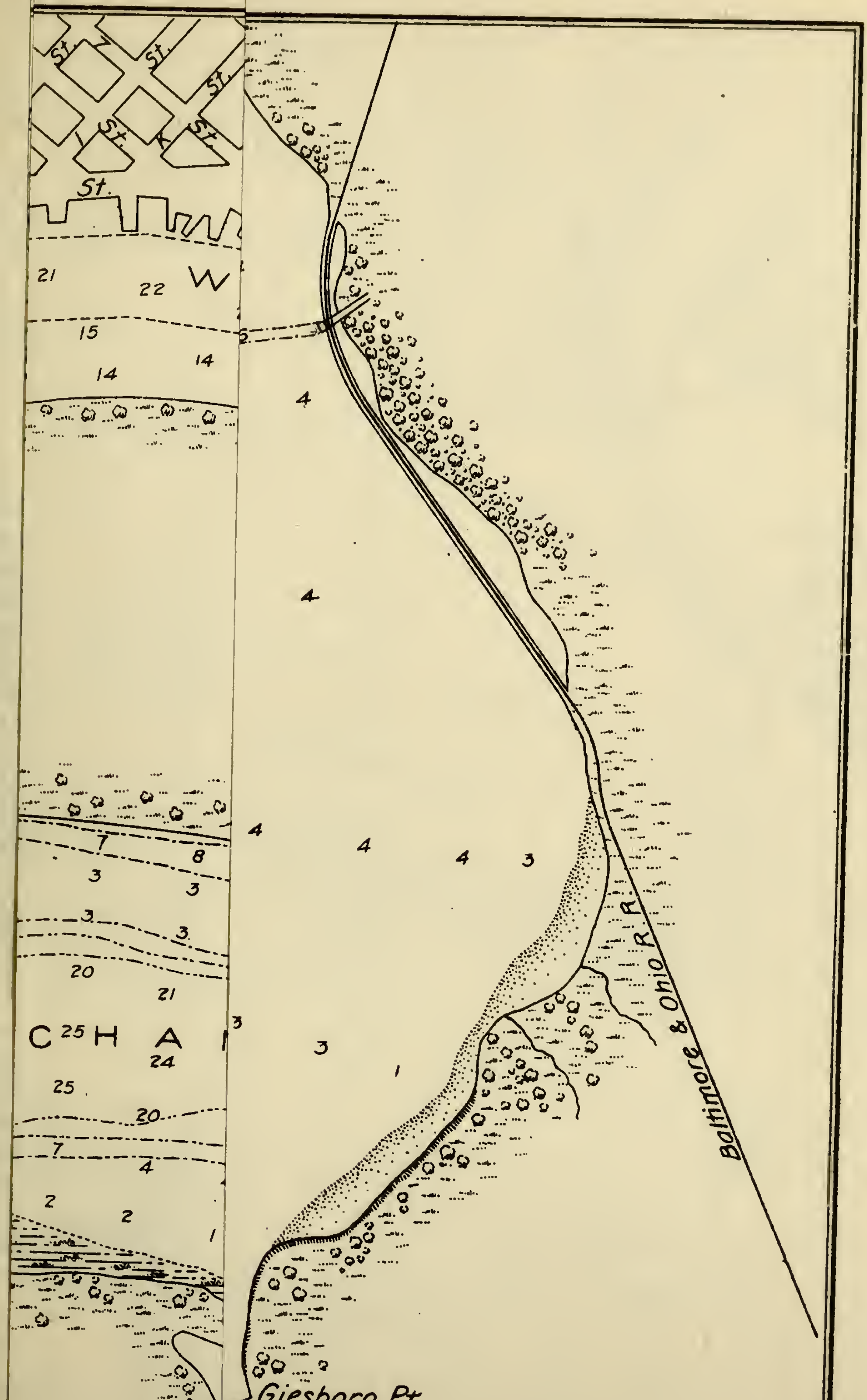
Ferry and local passenger steamers are not included in the above.

K 2.

IMPROVEMENT OF OCCOQUAN CREEK, VIRGINIA.

The present project for improvement, adopted December 5, 1890, and following an appropriation of $10,000, made September 19, 1890, provides for dredging and dike work at bars as follows:

Lower Mud.—A channel 6 feet deep to be dredged, the "upper section" for about 2,500 feet below Taylors Point to be 100 feet wide, the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COMMERCIAL STATISTICS.

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	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
1887	264,947	120,237	37,044	50,000	52,419	94,325	618,972
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Number of vessels of various classes arriving and departing.

Calendar year—	Steamers drawing from 5 to 15 feet, 100 to 600 tons.	Vessels drawing from 10 to 21 feet, 300 to 2,100 tons.	Vessels drawing from 4 to 10 feet, 30 to 300 tons.	Barges drawing from 5 to 12 feet, 100 to 600 tons.
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1891	980	445	1,854	862
1892	1,065	466	2,046	527
1893	906	431	2,301	450
1894	1,118	455	2,388	323
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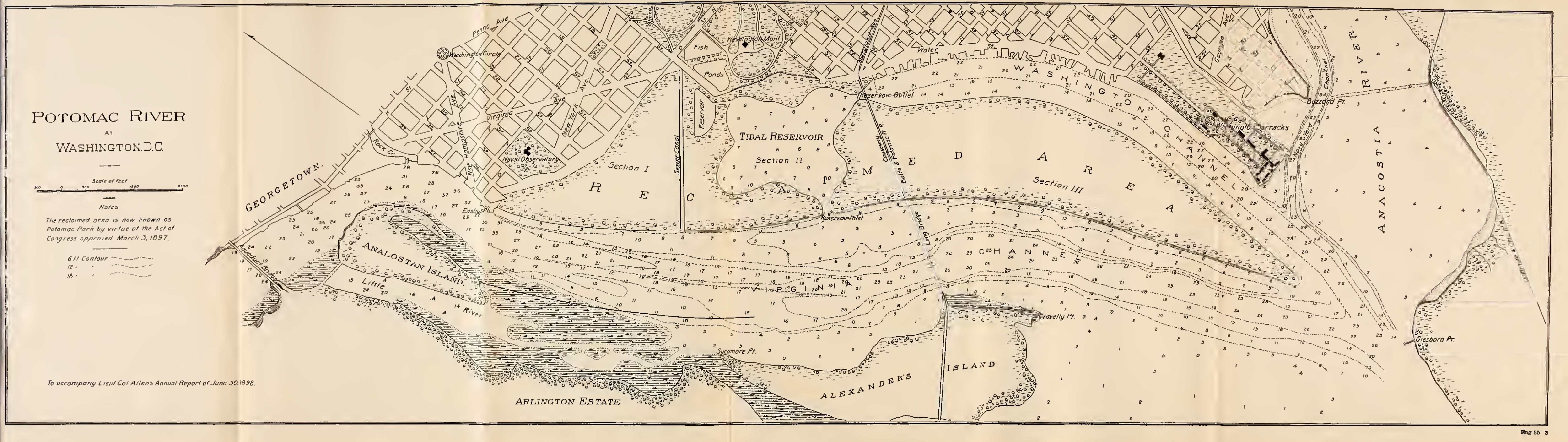

POTOMAC RIVER
AT
WASHINGTON.D.C.

Scale of Feet

Notes

The reclaimed area is now known as Potomac Park by virtue of the Act of Congress approved March 3, 1897.

6 ft Contour
12 " "
18 " "

To accompany Lieut Col Allen's Annual Report of June 30, 1898.

material to be deposited on the west side of the channel, and the remainder of the channel, or "lower section," to be 150 feet wide.

Upper Mud.—A channel 100 feet wide and 6 feet deep to be dredged, the material to be deposited on the east side of the channel and the embankment so formed connected with the left bank by a dike.

Sand Bar.—A channel 100 feet wide and 6 feet deep to be dredged, and sheet-pile dikes constructed to maintain the dredged channel.

Occoquan Bar.—A channel 100 feet wide and 6 feet deep to be dredged, and a dike to be constructed to maintain the depth.

The estimated cost of this (the present approved project) is $45,000.

The last appropriation for this work consisted of $3,000, made by act of September 19, 1890.

No field work was done during the season of 1896.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1898.

Proposals for dredging at Occoquan, Aquia, Nomini, and Lower Machodoc creeks, Virginia, were opened July 20, 1897. An abstract of the proposals received is appended to this report. The date for commencement of work proposed by the lowest bidders was May 1, 1898. They stated that they were unable to fix an earlier date. As the public interest demanded the execution of the dredging during the working season of 1897, the contract was awarded to the next lowest bidder, the Baltimore Dredging Company, which proposed to commence the work October 1, 1897, and complete it by December 31 of the same year. It was the understanding with this company that no extension of time for completing the contract should be granted or asked for. The contract was entered into August 16, 1897, and approved August 30, 1897.

As the work at Nomini Creek, Virginia, was the most exposed of the four works covered by the contract, the dredging at that locality was commenced first (about September 4, 1897), and upon completion was followed by that at the contiguous work of Lower Machodoc Creek, Virginia. Dredging operations at Occoquan Creek were next undertaken and were commenced at the Lower Mud October 7, 1897, with one dipper dredge. Work was continued without interruption until October 30, 1897, when the limit of dredging which was practicable with the available funds was reached. The work consisted entirely of redredging shoal portions of the channel through this bar. The material found was soft mud, which was removed in scows and deposited on a dumping ground on the north shore of Occoquan Bay. A clear width of 75 feet of channel 6 feet deep was secured by the redredging operations.

The amount of dredging at Occoquan Creek under this contract was 9,971 cubic yards.

PRESENT CONDITION OF THE IMPROVEMENT AND FUTURE WORK REQUIRED TO COMPLETE THE APPROVED PROJECT.

Channels 6 feet deep and 100 feet wide are now available through three bars, and dikes have been built at two of the bars. The channel through the Lower Mud has a width of 75 feet and a depth of 6 feet.

The work remaining to complete the project is the extension of the dike at Sand Bar, the construction of the dike at Upper Mud, and such dredging from time to time as may be needed to restore the channel dimensions called for by the project.

Occoquan Creek is in the collection district of Alexandria, which is also the nearest port of entry. The nearest light-house is at Fort Washington, Md.

Money statement.

July 1, 1897, balance unexpended	$2,465.00
June 30, 1898, amount expended during fiscal year	2,395.98
July 1, 1898, balance unexpended	69.02
Amount (estimated) required for completion of existing project	22,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	8,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made for the new project:

September 19, 1890	$10,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,500
Total	22,500

Abstract of proposals for dredging in Occoquan, Aquia, Nomini, and Lower Machodoc creeks, Virginia, opened July 20, 1897, by Lieut. Col. Chas. J. Allen, Corps of Engineers.

No.	Name and address of bidders.	Occoquan Creek, Virginia.		Aquia Creek, Virginia.					Nomini Creek, Virginia.	
				Deposited on sides of channel.		Removed in scows.		Total.		
		Per cubic yard.	10,000 cubic yards.	Per cubic yard.	13,000 cubic yards.	Per cubic yard.	5,000 cubic yards.		Per cubic yard.	8,000 cubic yards.
		Cents.		*Cents.*		*Cents.*			*Cents.*	
1	James H. Egan and Chas. G. Bochman, Charleston, S. C.	18	$1,800	12	$1,560	18	$900	$2,460	22	$1,760
2	Baltimore Dredging Co., Baltimore, Md.	18	1,800	18	2,340	18	900	3,240	22	1,760
3	John Miller, Washington, D. C	29	2,900	24	3,120	29	1,450	4,570	29	2,320
4	Chester T. Caler, Norfolk, Va	28	2,800	28	3,640	28	1,400	5,040	28	2,240

No.	Name and address of bidders.	Lower Machodoc Creek, Virginia.		Total amount of bid.	Commence.	Cubic yards per month.	Complete.
		Per cubic yard.	5,000 cubic yards.				
		Cents.					
1	James H. Egan and Chas. G. Bochman, Charleston, S. C.	20	$1,000	$7,020	May 1, 1898	10,000	Oct. 1, 1898
2	Baltimore Dredging Co., Baltimore, Md	22	1,110	7,910	Oct. 1, 1897	15,000	Dec. 31, 1897
3	John Miller, Washington, D. C.	29	1,450	11,240	Mar. 1, 1898	10,000	June 30, 1898
4	Chester T. Caler, Norfolk, Va	28	1,400	11,480	Apr. 1, 1898	[a] 10,000	do

[a] About.

CONTRACT IN FORCE.

Baltimore Dredging Company, dredging, dated August 16, 1897; approved August 30, 1897; date of commencement, October 1, 1897; date of completion, December 31, 1897.

COMMERCIAL STATISTICS.

[Furnished by Messrs. L. Ledman and Tyson Janney, Occoquan, Va.]

Receipts and shipments by water.

Articles.	1891.	1892.	1894.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Coal	100	100	100	100	100	150
Fertilizers				200		
Flour and grain	60	550	900	1,400	1,200	900
Lumber	600	800	320	200	300	210
Piles			1,000	100	2,150	
Railroad ties	3,600	3,000	3,600	2,500	7,000	4,000
Sand		48,000		5,000	23,400	5,000
Wood	3,500	3,600	2,400	750	7,120	2,400
Miscellaneous	345	655	580	225	400	3,175
Total	8,205	56,705	8,900	10,475	41,670	15,835

No new lines of transportation were established in 1897. It is reported that the work done has lessened the cost of shipping, since vessels can now load more heavily at the wharves, whereas formerly part of the cargo had to be taken out to them in lighter-draft boats.

K 3.

IMPROVEMENT OF AQUIA CREEK, VIRGINIA.

Aquia Creek is a tributary of the Potomac River, which it enters 41 miles below Washington, D. C.

Between 1872 and 1878 the sum of $10,000 was appropriated by Congress for the improvement and expended in dredging.

A new survey of the creek was authorized by the river and harbor act of August 11, 1888. On September 19, 1890, Congress appropriated $10,000 for the work. The following project was therefore adopted December 4, 1890: A channel to be dredged to a depth of 6 feet and width of 80 feet between the mouth and the Narrows, the material dredged below the railroad bridge to be removed in scows and that above the bridge for the most part to be deposited on the sides of the channel. Estimated cost, $21,000.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

Proposals for dredging at Aquia, Occoquan, Nomini, and Lower Machodoc creeks, Virginia, under one contract, were opened July 20, 1897. An abstract of the bids received will be found appended to the report for Occoquan Creek. For the reasons stated in the report upon Occoquan Creek, the contract was awarded to the Baltimore Dredging Company and was entered into August 16, 1897, and approved August 30, 1897. The contract prices for dredging in Aquia Creek were as follows:

For material deposited on the sides of the channel, 18 cents per cubic yard.

For material removed in scows, 18 cents per cubic yard.

The dredging at Aquia Creek was the last of the four works to be undertaken under the contract. The dredging operations were commenced November 4, 1897. The shoal portions of the channel below the bridge of the Richmond, Fredericksburg and Potomac Railroad were first dredged. This section of the work was completed November 6, 1897. The dredge was then taken through the draw, and on November 8, 1897, commenced the removal of shoals in the channel above the railroad bridge. This part of the work was completed November 13, 1897. The material removed from these two sections of the channel was removed in scows and deposited on a dumping ground in the Potomac River.

On November 16, 1897, the dredging of the uncompleted portion of the channel near the Narrows was commenced. The specifications required the material here dredged to be deposited on the outside of the channel, so as to form an embankment. A cut 8 feet wide was first dredged along each side of the channel and the material therefrom deposited directly with the dipper of the dredge outside and not less than 15 feet from the channel line, so as to form an embankment. The remaining material was then dredged and was deposited outside the small embankment first formed by means of a wooden chute 54 feet long built upon a light-draft scow. The work was satisfactorily completed on December 14, 1897, seventeen days before the time of expiration of the contract (December 31, 1897).

These dredging operations resulted in completing a dredged channel 80 feet wide and 6 feet deep between the mouth of the creek and the Narrows, and therefore completed the approved project of December 4, 1890.

BENEFIT TO COMMERCE AND NAVIGATION.

The work done has been of benefit to the existing trade of the creek by enabling vessels trading here to pass the long shoal below the Narrows into the upper part of the creek, where a sufficient depth exists up to the landing from which most of the shipments are now made.

PRESENT CONDITION OF THE IMPROVEMENT.

The project is now completed and provides a channel 80 feet wide and 6 feet deep from the mouth to the Narrows. No further appropriation is asked.

Aquia Creek is in the collection district of Alexandria, which is the nearest port of entry. The nearest light-house is at Maryland Point, Md.

Money statement.

July 1, 1897, balance unexpended	$3,587.90
June 30, 1898, amount expended during fiscal year	2,875.29
July 1, 1898, balance unexpended	712.61
July 1, 1898, outstanding liabilities	65.00
July 1, 1898, balance available	647.61

Appropriations.

The following appropriations have been made for the new work:

September 19, 1890	$10,000
July 13, 1892	5,000
August 18, 1894	3,000
June 3, 1896	3,000
Total	21,000

COMMERCIAL STATISTICS.

[Furnished by Mr. R. L. Flatford, Stafford, Va.]

Receipts and shipments by water, calendar year 1895.

	Tons.
Farm produce	150
Lumber	200
General merchandise	200
Railroad ties	10,000
Tobacco	8,000
Total	18,450

Arrival and departure of vessels.

Class.	Number.	Tonnage.
Steamers drawing less than 10 feet	240	24,000
Sail vessels drawing less than 10 feet	320	40,000
Barges, flatboats, etc	80	24,000

Repeated efforts were made to obtain commercial statistics for 1897, but they could not be procured.

K 4.

IMPROVEMENT OF NOMINI CREEK, VIRGINIA.

Nomini Creek enters the Potomac River about 82 miles below Washington, D. C. At the date of the survey, preliminary to the inception of the improvement (1872), its navigation was obstructed by a bar of oyster shells and sand at its mouth, over which but 3 feet could be carried at low tide. The dangers and difficulties in passing the bar were still further increased by strong cross tidal currents just inside the mouth at White Point. After passing the bar a wide and navigable stream is found, in which about 8 feet can be carried for about 3½ miles, or nearly to Nomini Ferry, while 5 feet can be carried for about 6 miles above the mouth.

PLAN OF IMPROVEMENT AND PRESENT PROJECT.

The original project, adopted in 1873, provided for dredging a channel through the bar 100 feet wide and 9 feet deep at low tide, with side slopes of 2 to 1, at an estimated cost of $20,000. The project was amended and modified in 1879, 1882, and 1885, and the estimate of cost was revised in 1888, the channel having deteriorated during the suspension of work 1883–1889. The project was further modified in 1890 so as to provide a dredged channel 9 feet deep and 150 feet wide; also two jetties, one from White Point on the east and one from Cedar Island on the west of the dredged channel. Dikes were also to be built inside White Point to check cross currents. The estimate of cost, as revised in 1897, was increased to $105,000.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1898.

Proposals for dredging in Nomini Creek, Virginia, under the same contract with dredging at Occoquan, Aquia, and Lower Machodoc creeks, Virginia, were opened July 20, 1897. An abstract of the bids received will be found appended to the report for Occoquan Creek, Virginia. For the reason stated in the report for Occoquan Creek, the contract was awarded to the Baltimore Dredging Company. The contract was entered into August 16, 1897, and approved August 30, 1897.

The price for dredging was 22 cents per cubic yard, the material to be removed in scows.

Dredging operations were commenced in the channel outside White Point on September 4, 1897. The dredge was in good order and the work, which consisted entirely of redredging, proceeded rapidly. For a width of 140 feet, measured from the west side of the channel, all the shoals found were redredged and removed between the outer end of channel and a point 3,000 feet inside the same. The remaining 10 feet in width on the east side of the channel could not be redredged for want of funds. Dredging operations were completed as far as the available funds would permit on September 24, 1897. The total amount of dredging was 8,000 cubic yards.

The ruling depth throughout the channel is 8 feet.

BENEFIT TO COMMERCE AND NAVIGATION.

An idea of the value of the improvement can be obtained by inspecting the table of commercial statistics given below.

The sum of $12,000 can be profitably expended during the fiscal year ending June 30, 1900, in dredging and jetty construction.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blackistone Island.

Money statement.

July 1, 1897, balance unexpended	$2,488.64
June 30, 1898, amount expended during fiscal year	2,426.79
July 1, 1898, balance unexpended	61.85
Amount (estimated) required for completion of existing project	45,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	12,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and sundry civil act of June 4, 1897.	

Appropriations.

The following appropriations have been made:

May 3, 1873	$10,000	August 11, 1888	$5,000
June 23, 1874	6,000	September 19, 1890	5,000
March 3, 1875	5,000	July 13, 1892	10,000
March 5, 1879	2,500	August 18, 1894	5,000
June 14, 1880	5,000	June 3, 1896	2,500
March 3, 1881	2,000		
August 2, 1882	2,000	Total	60,000

COMMERCIAL STATISTICS.

[Furnished by Mr. F. E. Tubman, Mount Holly, Va.]

Receipts and shipments by water.

Articles.	1892.	1893.	1894.	1895.	1896.	1897.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Coal	10	8	10	8	10	5
Farm produce	100	150	100	150	125	150
Grain	400	500	4,500	4,000	3,500	3,000
Lumber	500	400	6,000	5,000	400	100
Oysters	5,000	4,000	3,500	3,000	500	500
Railroad ties	5,000	4,500	3,000	3,000	2,000	2,500
General merchandise	10,000	....	....	90	90	115
Wood	....	8,000	8,000	1,000	800	1,000

Tonnage by years.

Year.	Tons.	Year.	Tons.
1889	13,542	1894	25,100
1890	15,825	1895	16,250
1891	62,300	1896	7,425
1892	[a]21,000	1897	7,370
1893	17,658		

[a] This calculation is for sailing vessels only. The steamers carry the great bulk of grain and merchandise.

No new lines of transportation were established in 1897. It is reported that the work done has materially lowered freight rates. There has been a general stagnation in business during the year, very little produce paying to handle it.

K 5.

IMPROVEMENT OF LOWER MACHODOC CREEK, VIRGINIA.

Lower Machodoc Creek is a tidal estuary of the Potomac River, which it enters on the right about 85 miles below Washington, D. C.

The project for improvement, adopted November 29, 1892, provides for dredging a channel 150 feet wide and 9 feet deep at low tide through the bar at the Narrows, at an estimated cost of $15,000.

WORK DONE DURING THE FISCAL YEAR ENDED JUNE 30, 1898.

Proposals for dredging, to be done under the appropriation of $1,500 made by the act of June 3, 1896, were opened July 20, 1897, the dredging for this work and for Nomini, Occoquan, and Aquia Creeks, Virginia, to be done under one contract. An abstract of the bids received will be found appended to the report on Occoquan Creek. For the reason stated in that report, the contract was awarded to the Baltimore Dredging Company. Dredging operations commenced at Narrows Bar September 25, 1897, and consisted in widening the 9-foot channel on the easterly side and in deepening the channel where shoaling had occurred from the unfinished condition of the work. The dredging was continued until October 4, 1898, when the limit of dredging which was practicable under the appropriation was reached and operations were suspended. The resulting widths of the 9-foot channel were from 85 to 110 feet, the length (on the side) now being about 1,700 feet. The amount of dredging under the contract was 4,957 cubic yards.

The dredged channel is now 150 feet wide, the least depth outside of the above-named widths (85 to 110 feet) being 6 feet.

The sum of $3,000 can be profitably expended during the fiscal year ending June 30, 1900, in continuance of dredging.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is at Blackistone Island.

Money statement.

July 1, 1897, balance unexpended	$1,565.60
June 30, 1898, amount expended during fiscal year	1,472.30
July 1, 1898, balance unexpended	93.30
Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	3,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

July 13, 1892	$3,000
August 18, 1894	3,000
June 3, 1896	1,500
Total	7,500

COMMERCIAL STATISTICS.

Repeated efforts have been made to obtain commercial statistics pertaining to this work, but without success.

K 6.

IMPROVEMENT OF RAPPAHANNOCK RIVER, VIRGINIA.

The Rappahannock River is navigable from its mouth in Chesapeake Bay to Fredericksburg, Va., a distance of 106 miles.

The river drains a large area of agricultural country, and is subject to freshets. The highest known freshet occurred in June, 1889, when the river rose to 32.8 above low tide at Fredericksburg. The freshet slope falls below Fredericksburg as the river widens. Freshets are but little felt at Port Royal and not at all at Tappahannock. They bring down large quantities of sediment and are the chief factors in bar formation. Tides range from 2.5 feet at the mouth to 3.4 feet at Fredericksburg. Tappahannock is 41 miles and Port Royal 77 miles from the mouth of the river.

In 1871, prior to the inception of the improvement, 6 feet could be carried to within a mile of Fredericksburg, and from that point 4 feet to the town.

The obstructions to navigation lie between Tappahannock and Fredericksburg, 65 miles. The original condition of the bars was as follows:

Naylor Hole (44 miles above the mouth).—A detailed survey of the bar, made in 1885, showed the least depth to be 10.7 feet. The length of the bar between the 15-foot curves was 11,000 feet. Boring showed sand, mud, and gravel.

Nanzatico Reach (72 miles above the mouth and 4 miles below Port Royal).—The ruling depth on the bar is 10.1 feet (survey of 1885), although in the track which can be conveniently followed by steamers the depth is 8.3 feet. The length of the bar between the 15-foot curves is 5,540 feet. The bar is composed for the most part of soft mud.

Farleyvale Bar (94 miles above the mouth and 12 miles below Fredericksburg).—In 1881, before improvement, 9 feet could be carried over this bar, although the depth on the best course was but 8.3 feet. The bar was composed of sand, mud, and gravel, and was about 200 feet long between the 10-foot curves.

Castle Ferry Bar (98 miles above the mouth and 8 miles below Fredericksburg).—The least depth in 1876, before improvement, was 8.4 feet and the length between the 10-foot curves 1,400 feet. The bar is composed of sand and mud.

Spottswood Bar (102 miles above the mouth and 4 miles below Fredericksburg).—In 1871 this bar was 5,400 feet long, with a least depth of 6 feet at the "cross over," where there were three wrecks sunk during the late war. Before improvement this was the most troublesome bar on the river below Fredericksburg Bar, and steamers often grounded here.

Pratt Reach Bar (103 miles above the mouth and 3 miles below Fredericksburg).—The ruling depth before improvement was 8.1 feet and the length between the 10-foot curves about 400 feet. The material is sand and gravel.

Pollock Bar (105 miles above the mouth of the river and 1 mile below Fredericksburg).—The bar was about 700 feet long in 1882, before its improvement was commenced, and the ruling depth 7 feet. At the head of the bar and near the right bank there was a ledge of rock on which the depth was from 6 to 7 feet.

Fredericksburg Bar.—This bar commences 1 mile below the railroad bridge at Fredericksburg and extends up to and along the entire wharf front of the town to the bridge. The ruling depth in 1871 was 4 feet. The bar was formed and is constantly renewed by deposits of sand brought down by the recurring freshets. In 1871 six wrecks obstructed the channel over this bar.

The navigation of the Rappahannock is sometimes obstructed by trees and snags carried into the river by freshets.

PLAN OF IMPROVEMENT AND PRESENT APPROVED PROJECT.

The original project, approved in 1871, was to secure a channel 100 feet wide and 10 feet deep by dredging and the construction of dikes from Fredericksburg to Tappahannock, the wrecks obstructing the channel to be removed. In 1879 the project was amended to provide for a dredged channel 100 feet wide and 10 feet deep between Fredericksburg and Port Royal and one 200 feet wide and 15 feet deep between the latter place and Tappahannock, the depths secured to be maintained by a system of wing dams and training dikes. Total cost of project as revised $381,500.

The sum expended to include June 30, 1897, resulted in improving the seven bars between Fredericksburg and Port Royal by dredging and the construction of dikes and removal of wrecks and snags. The results of the improvement at these bars at the date of the latest examinations are given in the following table:

Locality.	Depth at low water before improvement.	Ruling channel depth at low water at date of latest survey.
	Feet.	*Feet.*
Fredericksburg Bar, below steamboat wharf	4	8.6 (1897)
Pollock Bar	7.3	9 (1894)
Bernard Bar	8.5	10 (1894)
Pratt Bar	8.3	9.2 (1894)
Spottswood Bar	6	8.2 (1894)
Castle Ferry Bar	8	9.5 (1894)
Farleyvale Bar	8	10 (1894)

No work has yet been done at Nanzatico Reach and Naylors Hole.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1898.

Under date of August 25, 1897, proposals were invited by public advertisement for dredging at Fredericksburg Bar and for rock excavation at the lower end of Fredericksburg Reach, the work to be done in connection with dredging proposed at Urbana Creek, Virginia, and under the same contract. Only one proposal was received, which was opened September 25, 1897. An abstract of this proposal is appended to this report. The price bid for dredging at Fredericksburg was too high and the bid was therefore rejected. As there seemed no immediate prospect of obtaining favorable bids, further action was deferred until the working season of 1898.

During the month of June, 1898, specifications were prepared with a view to public advertisement inviting proposals for the dredging and rock excavation. The advertisement will be made in July.

The sum of $15,000 can be profitably expended during the fiscal year ending June 30, 1900.

The work is in the collection district of Tappahannock, which is the nearest port of entry. The nearest light-house is that at Blackistone Island.

Money statement.

July 1, 1897, balance unexpended	$9,952.63
June 30, 1898, amount expended during fiscal year	63.01
July 1, 1898, balance unexpended	9,889.62
July 1, 1898, outstanding liabilities	1.12
July 1, 1898, balance available	9,888.50
Amount (estimated) required for completion of existing project	129,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	15,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

March 3, 1871	$15,000	July 5, 1884	$20,000
June 10, 1872	15,000	August 5, 1886	20,000
March 3, 1873	15,000	August 11, 1888 ($15,000, of which $3,000 was for Urbana)	12,000
June 23, 1874	7,000	September 19, 1890	15,000
March 3, 1875	5,000	July 13, 1892	20,000
August 14, 1876	10,000	August 18, 1894	10,000
August 18, 1878	13,500	June 3, 1896	8,000
March 3, 1879	10,000		
June 14, 1880	25,000	Total	252,500
March 3, 1881	15,000		
August 2, 1882	17,000		

Abstract of proposals for rock excavation and dredging in Rappahannock River and dredging in Urbana Creek, Virginia, opened September 25, 1897, by Lieut. Col. Chas. J. Allen, Corps of Engineers.

Name.	Rappahannock.				
	Rock excavation.		Dredging.		Amount.
	Per cubic yard.	1,660 cubic yards.	Per cubic yard.	10,000 cubic yards.	
John Miller, Washington, D. C	$2.50	$4,150	*Cents.* 36⅖	$3,640	$7,790

Name.	Urbana.		Total.	Commence.	Complete.
	Dredging.				
	Per cubic yard.	Amount (10,000 cu. yds).			
John Miller, Washington, D. C	*Cents.* 25	$2,500	$10,290	Nov. 1, 1897	May 1, 1898

COMMERCIAL STATISTICS.

Tonnage for—	Tons.	Tonnage for—	Tons.
1888	83,600	1894	*144,070
1890	83,830	1895	*151,466
1892	*126,333	1896	*161,196
1893	*141,750	1897	*158,108

Arrivals and departures of vessels, 1897.

Steam vessels:	
Drawing 10 feet or more	540
Drawing less than 10 feet	164
Sailing vessels:	
Drawing 10 feet or more	860
Drawing less than 10 feet	256
Barges, flatboats, etc	420

The principal articles of commerce are grain, oysters, fertilizers, cattle, farm produce, and general merchandise.

No new lines of transportation were established in 1897. It is reported that the work done on this improvement has greatly reduced freight rates, both by rail and water.

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*Furnished by Mr. William D. Scott, Fredericksburg, Va.

K 7.

IMPROVEMENT OF URBANA CREEK, VIRGINIA.

Urbana Creek is a tributary of the Rappahannock River, which it enters 16 miles above the mouth.

The project for improvement, adopted in 1879, was the excavation of a channel 150 feet wide and 10 feet deep through the outer bar. It was modified in 1883 so as to include dredging a channel through the shoal within the creek, and again in 1888 to include dikes or jetties along the sand spit at the mouth to prevent the natural channel from closing. In April, 1897, a survey was made to determine the extent of change in the channels, and an estimate was made in June following of the cost of completing the project by means of dredging and a jetty to protect the channel through the outer bar. The cost, added to the amounts previously expended, made the revised estimated cost of the project $70,000.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1898.

Under date of August 25, 1897, proposals were invited by public advertisement for dredging in the channel through the outer bar, and also, if the funds permitted, at the shoal within the creek, in connection with the dredging and rock excavation proposed near Fredericksburg in the Rappahannock River, all the work to be done under a single contract. A single proposal was received and opened September 25, 1897. An abstract of this proposal will be found appended to the report on Rappahannock River. The price bid for dredging in Rappahannock River was too high, and the proposal was rejected. Further action was then deferred until the working season of 1898. Proposals will be again invited in July for the above-mentioned work, the specifications being framed so that separate proposals can be made for the dredging and rock excavation. The works will be offered together on account of the small amounts available for each.

The work done under the various appropriations resulted in a channel 10 feet deep and from 130 to 150 feet in width through the outer bar, while a channel 10 feet deep and from 80 to 170 feet in width had been dredged within the creek, although examinations in 1897 indicated some deterioration of the creek channel.

The work required to complete the project is completion of the outer channel to the depth of 10 feet and width of 150 feet, some dredging at the turn at the inner end of this channel, dredging in the creek channel, and construction of the jetty for the outer channel. With the funds available from the appropriation of June 3, 1896, it is expected to nearly, if not quite, complete the dredging required in the outer channel.

The sum of $20,000 can be profitably expended during the fiscal year ending June 30, 1900, in dredging and in commencing the construction of the jetty for maintaining the depth in the outer channel.

The accompanying statistics show the value of the commerce depending upon this improvement.

For more complete account of the improvement see annual report for the fiscal year ended June 30, 1896.

Urbana is a port of entry in the collection district of Tappahannock. The nearest light-house is that at Bowler Rock.

Money statement.

July 1, 1897, balance unexpended	$2,959.10
June 30, 1898, amount expended during fiscal year	18.54
July 1, 1898, balance unexpended	2,940.56
Amount (estimated) required for completion of existing project	39,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

March 3, 1879	$5,000
June 14, 1880	2,500
March 3, 1881	4,000
August 2, 1882	4,000
August 11, 1888 (included in an appropriation of $15,000 for Rappahannock River)	3,000
September 19, 1890	$3,000
July 13, 1892	3,000
August 18, 1894	3,000
June 3, 1896	3,000
Total	30,500

COMMERCIAL STATISTICS.

Calendar year—	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.
	Tons.	*Tons.*
1891	19,500	22,100
1892	20,095	17,125
1893	55,885	61,290
1894	82,395	88,305
1895	66,530	92,320
1896	137,485	133,925
1897	153,875	181,500

The principal articles of commerce are oysters, tobacco, railroad ties, coal, grain, and lumber.

Arrivals and departures of vessels, 1897.

Description.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.
Steamers drawing 10 feet or more	140	150
Steamers drawing less than 10 feet	800	850
Sail vessels drawing 10 feet or more	130	150
Sail vessels drawing less than 10 feet	1,100	1,000
Total	2,170	2,150

A daily mail steamer line, running from Carters Creek, or Irvington, to Urbana, was established during 1896. It is reported that the work done on this improvement has greatly reduced freight rates and permitted the use of larger vessels.

K 8.

IMPROVEMENT OF YORK RIVER, VIRGINIA.

The York River is formed by the union of Mattaponi and Pamunkey rivers at Westpoint, Va., is 41 miles in length, and empties into Chesapeake Bay about 16 miles above Old Point. Entering the river, 24 feet can be carried for 32 miles up, to Potopotank Bar, 9 miles below Westpoint. In 1880 the ruling depth on this bar was 18.5 feet, and its length between the 20-foot curves was 2,200 feet. The next obstruction to navigation is Westpoint Bar, which commences about 2 miles below Westpoint and extends up to Westpoint. Before improvement it had a ruling depth of 15.5 feet. Westpoint is the shipping point of the Richmond and Westpoint Terminal Railroad system. The wharves from which shipments are made are built within the mouth of Pamunkey River, and further obstruction to navigation is found in shoal water in front of these wharves.

The present project for improvement of this river, adopted in 1887, provides for dredging a channel 22 feet deep and 400 feet wide through the Potopotank and Westpoint bars and increasing the width of channel at the Westpoint wharves. The construction of a dike along the right bank of the river at Westpoint Bar, about 8,800 feet in length, forms part of the project. The total estimated cost of the project is $308,800.

OPERATIONS FOR THE FISCAL YEAR ENDING JUNE 30, 1898.

In view of the recent change in the present trade conditions in York River, due to the establishment by the Southern Railway Company of a new cotton shipping terminal at Norfolk, Va., in addition to their water terminal at Westpoint, referred to in detail in Appendix J 8 to the Annual Report of the Chief of Engineers for 1897, it was deemed advisable to expend the appropriation of June 3, 1896, in preserving the channel already secured by dredging, rather than by increasing the dimensions of that channel at the present time. It was accordingly proposed in the modified project approved September 2, 1897, to extend the existing dike on the right of the upper part of the dredged channel, so as to maintain the lower part of that channel. Specifications and plans for the dike were accordingly prepared, and it was intended to advertise inviting proposals for doing the work in time for its commencement early in the season of 1898. On account of the expected war with Spain it was deemed best to defer action for a time, but further developments indicated that there would be no war risk attending the work to induce high priced bids, and accordingly, under date of July 7, 1898, the specifications were issued and proposals invited for construction of the dike.

CONDITION OF THE IMPROVEMENT AND FUTURE WORK REQUIRED TO COMPLETE THE PROJECT.

Until 1894 the lack of contraction works prevented the securing of permanent results from the dredging at Westpoint Bar. The dike at that bar, built in 1893–94, has had a good effect in maintaining the dredged depth in the upper reach of the channel, and its extension for 3,500 feet to a point about opposite the lower end of the second reach of the channel, for the same purpose, is desirable. The greater part of this extension can be provided for with funds now available. The work remaining to be done under the approved project is the completion of the dredging at Potapotank and Westpoint bars and the completion of the dike at the latter-named bar.

It is estimated that $20,000 will be needed for a profitable prosecution of the work during the fiscal year ending June 30, 1900.

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is that at Bell Rock.

Money statement.

July 1, 1897, balance unexpended	$17,971.88
June 30, 1898, amount expended during fiscal year	306.50
July 1, 1898, balance unexpended	17,665.38
July 1, 1898, outstanding liabilities	29.17
July 1, 1898, balance available	17,636.21
Amount (estimated) required for completion of existing project	79,050.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

June 14, 1880	$10,000	September 19, 1890	$30,000
March 3, 1881	25,000	July 13, 1892	35,000
August 2, 1882	25,000	August 18, 1894	20,000
July 5, 1884	20,000	June 3, 1896	16,000
August 5, 1886	18,750		
August 11, 1888	30,000	Total	229,750

These appropriations have been applied to work under the original project of 1880, the amended project of 1884, and the further amended project of 1887.

COMMERCIAL STATISTICS.

[Furnished by Mr. E. T. Lamb, West Point, Va.]

Receipts and shipments.

Class of goods.	1891.	1892.	1893.	1894.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Coal	10,960	10,498	10,423	20,000
Cotton	89,227	63,742	67,485	72,235
Farm produce	5,641	3,500	4,000	5,000
Grain	3,220	....	100	150
Iron	43,897	45,501	45,033	41,227
Lumber	7,848	6,081	7,375	8,175
Oysters	12,400	2,780	3,200	2,500
General merchandise	70,930	191,462	188,054	206,706
Railroad ties	14,140	5,000	6,500	1,600
Tobacco	175	8,500	10,000	12,115
Wood	45,900	8,495	9,220	10,000

Vessels arriving and departing.

Class.	1891.	1892.	1893.	1894.
Steamers drawing 10 feet or more	727	724	792	758
Steamers drawing less than 10 feet	104	208	311	310
Vessels drawing 10 feet or more	178	96	90	95
Vessels drawing less than 10 feet	824	190	204	200
Barges, flatboats, etc	191	18	21	10

Statement of tonnage by years.

Reported for—	Tons.	Reported for—	Tons.
1888	285,480	1892	345,559
1889	328,353	1893	351,390
1890	418,190	1894	379,808
1891	304,338		

Repeated efforts were made to obtain commercial statistics for 1895, 1896, and 1897, but they could not be procured.

K 9.

IMPROVEMENT OF MATTAPONI RIVER, VIRGINIA.

The Mattaponi and Pamunkey rivers unite at Westpoint, Va., to form the York River. The Mattaponi is navigable for small steamers and vessels from its mouth, at Westpoint, to Aylett, a distance of 38.8 miles, and can be made navigable for small barges for 16 miles above Aylett, to Monday Bridge. The obstructions to 5.5-foot navigation below Aylett are as follows:

Designation.	Distance above West Point, Va.	Length of bar.	Ruling depth at low tide.
	Miles.	*Feet.*	*Feet.*
Line Tree Bar	31.4	2,100	3.8
Latané Bar	32.9	4,500	3
Robinson Bar	33.9	3,500	2.8
Presque Isle Bar	35.1	1,600	3.2
Sale Bar	35.6	1,000	3.1
Walker Bar	36.4	1,900	2.4
Jones Bar	37.3	950	3.1

Above Aylett there are numerous bars, but no work on them was proposed. The river was also obstructed by snags, overhanging trees, and wrecks.

The present project for improvement provides for removal of snags, logs, leaning trees, wrecks, etc., as far upstream as Guineas Bridge, near Milford Station, on the Richmond, Fredericksburg and Potomac Railroad, and the improvement of bars below Aylett. The object is to afford a depth of 5½ feet, and a channel width of 40 feet, at low tide, below Aylett, and above that point, to confine the improvement to removal of snags, etc.

The estimated cost of the project, as adopted in 1892, is $72,100.

OPERATIONS FOR FISCAL YEAR ENDING JUNE 30, 1898.

Under date of June 25, 1897, proposals had been invited by public advertisement for dredging at Line Tree and Latané bars, under the same contract with the dredging proposed in Pamunkey River, the dredging to be done under the appropriation of $2,500 by act of June 3, 1896, and a balance of $2,500 remaining from former appropriations.

The date fixed for the opening of proposals was July 24, 1897, but no bids were received on that day.

The work was again offered for contract by public advertisement under date of August 25, 1897, the date fixed for opening bids being September 25, 1897. On the last-named date a single proposal was received, an abstract of which is appended to this report. The proposal was regarded as too high, and was rejected. Owing to the small amount of work there seemed to be no prospect of obtaining a reasonable price for the dredging, and further action was deferred until conditions should be more favorable.

BENEFIT TO COMMERCE AND NAVIGATION.

The work already done upon this river has been of benefit to existing commerce, notwithstanding that much of it has had to be done over again, as snags and other obstructions form in greater or less degree after every freshet. Before any work of improvement was undertaken the trade was limited. There is now one steamer plying between Westpoint and Walkerton (29 miles). Above this point a lighter draft steamer runs to Aylett, 38.8 miles above Westpoint. Below Walkerton numerous vessels load with wood, lumber, etc., for coast ports. The total freight tonnage for 1894 was 39,300 tons. In this connection see commercial statistics herewith.

The sum of $4,000 can be profitably expended during the fiscal year ending June 30, 1900, in continuing work under the approved project.

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, Virginia.

Money statement.

July 1, 1897, balance unexpended	$5,005.79
June 30, 1898, amount expended during fiscal year	89.73
July 1, 1898, balance unexpended	4,916.06
Amount (estimated) required for completion of existing project	42,300.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	3,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made:

June 14, 1880	$2,500
March 3, 1881	3,300
July 5, 1884	2,500
August 5, 1886	5,000
August 11, 1888	3,000
September 19, 1890	3,000
July 13, 1892	$4,000
August 18, 1894	4,000
June 3, 1896	2,500
Total	29,800

Abstract of proposals for dredging in Mattaponi and Pamunkey rivers, Virginia, opened September 25, 1897, by Lieut. Col. Charles J. Allen, Corps of Engineers.

Name.	Mattaponi.		Pamunkey.		Total.	Commence.	Complete.
	Per cubic yard.	Amount (11,600 cubic yards).	Per cubic yard.	Amount (9,200 cubic yards).			
John Miller, Washington, D. C	*Cents.* 36⅖	$4,222.40	*Cents.* 36⅖	$3,348.80	$7,571.20	Nov. 1, 1897	May 1, 1898

COMMERCIAL STATISTICS.

Receipts and shipments.

Class of goods.	Calendar year—				
	1890.	1891.[a]	1892.[a]	1893.[a]	1894.[a]
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Coal					1,000
Farm products		2,400		300	500
Grain		1,000		100	350
Lumber	7,700	1,200	5,500	6,200	6,000
Merchandise	10,400	3,120	15,570	17,820	16,000
Ties	6,900	5,640	5,000	5,260	3,200
Wood	7,650	38,700	6,620	6,740	12,250
Total	32,650	52,060	32,690	36,420	39,300

[a] Furnished by Mr. E. T. Lamb, Westpoint, Va.

Vessels arriving and departing during 1894.

Class.	Number.	Tonnage.
Steam, drawing less than 10 feet	175	9,000
Sail, drawing 10 feet or more	100	30,000
Sail, drawing less than 10 feet	90	15,000
Barges, flatboats, etc	5	400
Total	370	54,400

Repeated efforts were made to obtain commercial statistics for 1895, 1896, and 1897, but they could not be procured.

K 10.

IMPROVEMENT OF PAMUNKEY RIVER, VIRGINIA.

The project for improvement of this river, adopted in 1880 and amended in 1885, provides for 7-foot navigation to Bassett Ferry, 47 miles from Westpoint, which is at the mouth of the Pamunkey; thence from Bassett Ferry to Wormley Landing, 54 miles from Westpoint, for 5-foot navigation; thence 3-foot navigation to Hanovertown, the 7-foot channel to have a width of 100 feet and the other channels 40 feet. The wrecks, logs, snags, and trees obstructing navigation between Garlick Ferry and Hanovertown were also to be removed. The cost of this amended project, which is also the present project, was estimated as $32,500.

WORK OF THE FISCAL YEAR ENDING JUNE 30, 1898.

Under date of June 25, 1897, proposals were invited by public advertisement for dredging at Buckland Bar under the same contract with the dredging proposed in Mattaponi River, Virginia. The date fixed for the opening of proposals was July 24, 1897, but no bids were received on that day. The work was again offered for contract by public advertisement dated August 25, 1897, the bids to be opened September 25, 1897. On the last-named day a single proposal was received, an abstract of which is appended to the report on Mattaponi River. This proposal was too high and was rejected.

As there seemed to be no immediate prospect of obtaining a reasonable price for the work, further action was deferred until conditions should be more favorable.

The sum of $3,000 can be profitably expended during the fiscal year ending June 30, 1900, in dredging and removal of snags, logs, and wrecks.

The work is in the collection district of Richmond, which is the nearest port of entry. The nearest light-house is Bell Rock, Virginia.

Money statement.

July 1, 1897, balance unexpended	$3,682.84
June 30, 1898, amount expended during fiscal year	34.85
July 1, 1898, balance unexpended	3,647.99
Amount (estimated) required for completion of existing project	7,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

The following appropriations have been made:

June 14, 1880	$2,500
March 3, 1881	2,500
August 2, 1882	2,500
August 5, 1886	5,000
August 11, 1888	3,000
September 19, 1890	3,000
July 13, 1892	$3,000
August 18, 1894	2,000
June 3, 1896	2,000
Total	25,500

COMMERCIAL STATISTICS.

[Furnished by Mr. E. T. Lamb, Westpoint, Va.]

Receipts and shipments.

Articles.	1893.	1894.
	Tons.	*Tons.*
Coal		5,000
Grain	75	750
Ice	5,145	
General merchandise	100	10,000
Lumber	10,000	1,000
Railroad ties	15,000	15,000
Wood	20,100	10,500
Total	50,420	42,250

Repeated efforts were made to obtain commercial statistics for 1895, 1896, and 1897, but they could not be procured.

K II.

IMPROVEMENT OF JAMES RIVER, VIRGINIA.

The present project for improvement of this river is in accordance with the act of Congress of July 5, 1884. It has in view the obtaining a depth of 22 feet at mean low tide from the sea to Richmond, the channel widths to be 400 feet from the sea to City Point, 300 feet thence to Drewry Bluff, and 200 feet thence to Richmond. The estimated cost of this project, which was a modification of the original project, is $4,500,000. The work for accomplishing this effect has been excavation through shoals by dredges, removal of rock, and construction of dikes and jetties to regulate the waterway in part. Work has been generally done first on the shoalest places in the river, with a view to obtaining the greatest benefit to commerce in the shortest time. Solid rock excavation has constituted a large item of the work, and more of the same remains to be done. It is necessarily costly.

WORK OF THE FISCAL YEAR.

The contract with P. Sanford Ross, dated December 11, 1894, approved on the 14th of that month, was completed July 15, 1897. The contract was for dredging and removal of rock and the piece of river from which the material was removed extended 1.5 miles below the Richmond City line. The total quantities excavated under this contract in July, 1897, and in previous fiscal years was as follows:

	Earth.	Cobble.	Soft rock.	Solid rock.	Total.
	Cubic yds.	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*
February to June, 1895	116, 251. 5	....	....	....	116, 251. 5
1895–96, fiscal year	28, 285. 8	1, 517. 8	7, 511. 9	10, 389. 0	47, 704. 5
1896–97, fiscal year	18, 111. 3	1, 075. 2	26, 497. 5	6, 875. 8	52, 859. 8
July, 1897	394. 4	12. 2	953. 7	352. 2	1, 712. 5
Total under this contract	163, 043. 0	2, 605. 2	34, 963. 1	17, 617. 0	218, 528. 3

On September 27, 1897, proposals were invited, by public advertisement in newspapers, for deepening and widening the channel of James River and for constructing, repairing, and revetment of wing dams, the work to be done between the lower city line of Richmond and a point about 1½ miles below that line. Amount of contract, about $21,000. At the opening of proposals, October 27, P. Sanford Ross was the lowest bidder and contract was accordingly made with him November 12, 1897. The contract was approved November 19. Work under the contract was to commence on or before November 15, 1897, and be completed on or before June 30, 1898.

An abstract of the bids received October 27 is appended to this report.

This contract was completed about June 28, 1898. The amount of work done under it was as follows:

Excavated from the channel.

	Cubic yards.
Earth	2, 532. 3
Cobble	350. 2
Soft rock	6, 070. 3
Solid rock	3, 035. 6
Total	11, 988. 4

All of this was placed in revetment or extension of wing dams between Nos. 16 and 74, from 1 to 4 miles below Richmond.

Adding the amount done in July, 1897, under the previous contract, the excavation during the fiscal year was as follows:

	Cubic yards.
Earth	2, 926. 7
Cobble	362. 4
Soft rock	7, 024
Solid rock	3, 387. 8
Total	13, 700. 9

The excavation under the 1894 contract was also used in revetment or extension of wing dams.

The following amounts of timber were used during the fiscal year in wing dams:

Pine piles, driven and cut off	linear feet..	6, 889. 9
Oak piles, driven and cut off	do....	1, 070. 3
Sheet piling, driven and cut off	feet B. M..	52, 757. 8
Oak wales, in place	do....	12, 544. 6
Pine capping, in place	do....	12, 335. 5

The wing dams constructed, raised, repaired, and extended during the fiscal year are as follows:

	Linear feet.
New dams (timber):	
No. 16½	198.5
No. 16¾	106
Dams raised at shore ends (timber):	
No. 65	152.7
No. 66	298.8
No. 69	53.2
No. 70	287
No. 73	55.5
No. 74	253
Dams repaired and extended (timber):	
No. 35	111
No. 67	47
Dams repaired and extended (stone):	
No. 15	15.6
No. 22	49
No. 24	63

Of the results of the work of the fiscal year Mr. Whitcomb, assistant engineer, writes as follows:

> The 18 by 100 foot channel is completed to within 775 feet of Richmond City line, and from that point to Hampton Roads there is a channel with not less than 18 feet at mean low tide. Above that point a cut 25 feet wide at bottom has been made through Rocketts Reef and to within 170 feet of the city line. The old channel through the reef is found to have a few points of from 14.5 to 15 feet depth, or from 18 to 18½ feet at full tide. The navigable depth at full tide is about 18 feet.

A saving of about 5½ miles of difficult navigation was effected several years ago by the opening of Dutch Gap Cut-off.

The amount expended during the fiscal year ended June 30, 1898, was $50,130.73.

The value of the improvement already effected, the need of further improvement, and the relation of the same to the commerce of the river may be appreciated from the statistics appended to this report.

The sum of $400,000 can be profitably expended in furtherance of the approved project during the fiscal year ending June 30, 1900. The best results for this work can be obtained from liberal appropriations, which would in the end be most economical to the United States.

The accompanying is a copy of the report of Mr. Whitcomb, assistant engineer, for the fiscal year ended June 30, 1898.

Money statement.

July 1, 1897, balance unexpended		$69,969.89
June 30, 1898, amount expended during fiscal year		50,130.73
July 1, 1898, balance unexpended		19,839.16
July 1, 1898, outstanding liabilities	$1,100.00	
July 1, 1898, amount covered by uncompleted contracts	8,050.00	
		9,150.00
July 1, 1898, balance available		10,689.16

Amount (estimated) required for completion of existing project	3,467,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	400,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

The following appropriations have been made for this work:

July 11, 1870	$50,000	August 2, 1882	$75,000
March 3, 1871	50,000	July 5, 1884	75,000
June 8, 1872	50,000	August 5, 1886	112,500
March 3, 1873	75,000	August 11, 1888	225,000
June 23, 1874	50,000	September 19, 1890	200,000
March 3, 1875	50,000	July 13, 1892	200,000
August 14, 1876	60,000	August 18, 1894	100,000
June 18, 1878	70,000	June 3, 1896	120,000
March 3, 1879	75,000		
June 14, 1880	75,000	Total	1,772,500
March 3, 1881	60,000		

Abstract of proposals for deepening and widening the channel of James River, Virginia, and repairing, constructing, and revetting wing dams, opened on October 27, 1897, at 12 o'clock.

No.	Name of bidder.	Approximate amount of dredging and cost per item.							
		7,000 cubic yards of earth.		300 cubic yards of cobblestone.		7,630 cubic yards of soft rock.		2,460 cubic yards of solid rock.	
		Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.	Per cubic yard.	Amount.
1	P. Sanford Ross, Jersey City, N. J.	$0.25	$1,750.00	$0.40	$120.00	$0.40	$3,052.00	$4.70	$11,562.00
2	Jno. A. Curtis, Richmond, Va.	.34	2,380.00	.34	102.00	.34	2,594.20	4.95	12,177.00

No.	Name of bidder.	Wheelage.		Approximate amount of wing-dam work and cost per item.					
		14,000 cubic yards.		8,800 linear feet round pine piles, driven.		520 linear feet white-oak piles, driven.		22,000 feet B. M. white oak wales, in place.	
		Per cubic yard.	Amount.	Per foot.	Amount.	Per foot.	Amount.	Per 1,000 feet B. M.	Amount.
1	P. Sanford Ross, Jersey City, N. J.	$0.10	$1,400.00	$0.12	$1,056.00	$0.30	$156.00	$25.00	$550.00
2	Jno. A. Curtis, Richmond, Va	.24	3,360.00	.18	1,584.00	.30	156.00	30.00	660.00

No.	Name of bidder.	Approximate amount of wing-dam work and cost per item.				Total.	Time.	
		71,000 feet B. M. sheet piling, driven.		7,500 feet B. M. pine capping, in place.				
		Per 1,000 feet B. M.	Amount.	Per 1,000 feet B. M.	Amount.		Commence.	Complete.
1	P. Sanford Ross, Jersey City, N. J.	$17.00	$1,207.00	$20.00	$150.00	$21,003.00	Nov. 15, 1897	June 30, 1898
2	Jno. A. Curtis, Richmond, Va.	24.00	1,704.00	24.00	180.00	24,897.20	Jan. 1, 1898	Sept. 30, 1898

CONTRACTS IN FORCE DURING THE YEAR.

With P. Sanford Ross, for dredging and removal of rock, dated December 11, 1894; approved December 14, 1894; date of commencement, January 10, 1895. The contract time for completion was June 30, 1896. This time was extended to January 31, 1897, again to May 31, 1897, and finally to August 1, 1897.

With P. Sanford Ross, for dredging, blasting rock, and constructing wing dams; contract dated November 12, 1897; approved November 19, 1897; date of commencement, November 16, 1897; date of completion, June 30, 1898.

COMMERCIAL STATISTICS.

Receipts and shipments, in tons, by water during the calendar year 1897.

Articles.	Port of Richmond, Va.			Points on James River other than Richmond, Va.			Total tonnage.
	Receipts.	Shipments.	Amount.	Receipts.	Shipments.	Amount.	
Brick					6,290	6,290	6,290
Coal	47,622	1,350	48,972	5,565	350	5,915	54,887
Farm produce				190	4,527	4,717	4,717
Fertilizers	31,618	1,610	33,228	2,680		2,680	35,908
Flour				285		285	285
General merchandise	87,086	22,860	109,946	15,552	17,466	33,018	142,964
Grain	1,561		1,561		2,999	2,999	4,560
Ice	14,416		14,416				14,416
Iron	718	10,817	11,535				11,535
Lime, cement, and plaster	6,535	485	7,020	670		670	7,690
Lumber	1,409	2,767	4,176	6,385	134,430	140,815	144,991
Oil	1,600		1,600				1,600
Oysters and fish	1,366		1,366		897	897	2,263
Railroad ties		68,041	68,041		22,737	22,737	90,778
Salt	5,188		5,188				5,188
Tobacco		11,145	11,145				11,145
Wood and bark	27,281	2,080	29,361		93,331	93,331	122,692
Total	226,400	121,155	347,555	31,327	283,027	314,354	661,909

REPORT OF H. D. WHITCOMB, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Richmond, Va., July 1, 1898.

COLONEL: I have the honor to submit the following report of operations connected with the improvement of James River, Virginia, for the fiscal year ending June 30, 1898:

Surveys.—No surveys were made during the year below City Point, and the statements relating to that part of the river are taken from the report of the preceding fiscal year.

A few days were spent in soundings between wing dams B and No. 31 from July to October. In December soundings were taken between B and No. 80. Other similar work was done in April, 1898. In May and June soundings were taken from B to No. 134 and at Varina and Curles Neck shoals.

Weather condition and stage of river.—There was no ice to interfere with navigation or work on the improvement. There was no rise in the river from July to April of 2 feet on mean high tide or 4 feet on mid tide. A rise of 4.4 feet on mid tide occurred April 2 and one of 10.11 feet May 9, or 6.6 and 12.13 feet above zero or mean low tide. The low tide fell to 3.2 feet below zero February 16. The corresponding high tide was 0.86 above zero, from strong westerly winds.

Summary of tidal observations.

[June 1, 1897, to May 31, 1898, and June 1, 1893, to May 31, 1898.]

	Numbers of observations.	Lunitidal intervals.		Duration of ebb.	Height above ocean level at Fort Monroe.			Height above Richmond (zero).	Rise and fall.
		High water.	Low water.		High water.	Mid.	Low water.		
		h. m.	*h. m.*	*h. m.*	*Feet.*	*Feet.*	*Feet.*		*Feet.*
June, 1897, to May, 1898, all observations	701	4 10.3	11 31.4	7 21.1	3.151	1.205	—0.724	—0.803	3.875
June, 1897, to May, 1898, excluding observations ±1.4 mean	593	4 07.6	11 27.6	7 20.0	3.018	0.983	—1.055	—0.803	4.073
1893 to 1898, excluding observations ±1.4 mean	2,704	4 11.0	11 31.1	7 20.1	2.994	1.020	—0.957	—0.803	3.951

The lunitidal interval is from the next preceding transit, using local time. Ocean level or mid tide at Fort Monroe is supposed to be 0.803 feet above mean low tide at Richmond.

Work of the fiscal year.—Contractor P. Sanford Ross, of Jersey City, N. J., completed the contract approved December, 1894, on July 15, 1897. The amount of material removed from the channel was from within 1.5 miles below the Richmond City line. The total excavation under this contract in July, 1897, and in previous fiscal years was as follows:

	Earth.	Cobble.	Soft rock.	Solid rock.	Total.
	Cubic yds.	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*
February to June, 1895	116,251.5	....	....	....	116,251.5
1895-96, fiscal year	28,285.8	1,517,8	7,511.9	10,389.0	47,704.5
1896-97, fiscal year	18,111.3	1,075.2	26,497.5	6,875.8	52,859.8
July, 1897	394.4	12.2	953.7	352.2	1,712.5
Total under this contract	163,043.0	2,605.2	34,963.1	17,617.0	218,528.3

A contract with P. Sanford Ross was approved November 19, 1897, for completing the channel from about 800 to 7,000 feet below the Richmond City line to a depth not less than 18 feet by 100 feet wide at mean low tide; for raising shore ends of 6 wing dams to 6 feet above mean high tide; for the construction of 2 new wing dams; for repairs, extension, and revetment of other dams and for the further extension of the channel toward the city line, with such width as was practicable with available funds.

Work under this contract was begun December 17 in driving piles for the elevation of shore end of wing dams. Drilling and blasting was begun the 29th in removing points of rock found by the sweep to be above the datum of 18 feet below mean low tide, between Dam B and No. 26, or the quarry wharf.

All the exposed solid rock was drilled and blasted by January 25, 1898, and in the absence of a dredge to uncover other areas drilling was suspended until March 14.

The dredge arrived February 6 and removed the blasted material by the 16th, and began uncovering solid rock between Dam B and No. 1. The drill crew resumed work March 14th in extending the channel above wing dam B by a cut 25 feet wide at bottom, and from that time until June 22 the drill and dredge crews alternated in blasting and dredging. The drill crew was employed at times in raising fragments with the United States hoister which the dredge could not handle readily.

The results are the completion of the 18 by 100 foot channel to wing dam B, 775 feet below the city line, and an extension 18 feet deep, 25 feet wide, through Rocketts Reef to within 170 feet of the city line. This cut was also dredged to rock bottom for 100 feet more. This leaves an irregular width of 0 to 40 feet between the present channel and the new cut. As the present channel is in places but 60 feet wide, it was thought best not to impair navigation in it by contiguous blasting until a practicable width could be given of the 18-foot depth separately. It was also desirable to have a full section through the reef for information as to the probable cost of completing the full channel at that point. A record was kept of the drill penetration, which was to 22 feet or more, and of the character and position of soft and solid rock. This ought to furnish a more reliable basis for estimates hereafter.

The amount excavated under this contract, approved November 19, 1897, was as follows:

	Earth.	Cobble.	Soft rock.	Solid rock.	Total.
	Cubic yds.	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*
February to June, 1898	2,532.3	350.2	6,070.3	3,035.6	11,988.4

All of this was placed in revetment or extension of wing dams between No. 16 and No. 74, from 1 to 4 miles below Richmond, and 8,379.9 of this was wheeled from the scows an average of about 200 feet.

Adding the amount done in July under the previous contract, the excavation in the year was as follows:

	Earth.	Cobble.	Soft rock.	Solid rock.	Total.
	Cubic yds.	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*	*Cubic yds.*
Contract of December, 1894	394.4	12.2	953.7	352.2	1,712.5
Contract of November, 1897	2,532.3	350.2	6,070.3	3,035.6	11,988.4
Total	2,926.7	362.4	7,024.0	3,387.8	13,700.9

The excavation under the older contract was also used in revetment or extension of wing dams.

The work on wing dams was completed June 28.

The timber used in wing dams was as follows:

Pine piles, driven and cut off	linear feet	6,889.9
Oak piles, driven and cut off	do	1,070.3
Sheet piling, driven and cut off	feet B. M.	52,757.8
Oak wales, in place	do	12,544.6
Pine capping, in place	do	12,335.5

Wing dams constructed, raised, repaired, and extended.

	Linear feet.
New dams (timber):	
No. 16½	198.5
No. 16¾	106
Dams raised at shore ends (timber):	
No. 65	152.7
No. 66	298.8
No. 69	53.2
No. 70	287
No. 73	55.5
No. 74	253
Dams repaired and extended (timber):	
No. 35	111
No. 67	47
Dams repaired and extended (stone):	
No. 15	15.6
No. 22	49
No. 24	63
Timber dams	1,562.7
Stone dams	127.6
Total	1,690.3

The timber work in wing dams cost	$2,605.04
The wheeling of revetment cost	837.99
Total cost of 1,562.7 linear feet timber dams	3,443.03

Cost per linear foot, $2.20.

The cost of stone dams is included under excavation.

Results of the fiscal year.—The 18 by 100 foot channel is completed to within 775 feet of Richmond City line, and from that point to Hampton Roads there is a channel with not less than 18 feet at mean low tide. Above that point a cut 25 feet wide at bottom has been made through Rocketts Reef and to within 170 feet of the city line. The old channel through the reef is found to have a few points of from 14.5 to 15 feet depth, or from 18 to 18½ feet at full tide. The navigable depth at full tide is about 18 feet instead of 19½ feet, stated in the last Annual Report. The last previous survey was in 1889. The removal of 500 cubic yards would reduce these points to not less than 18 feet below mean low tide.

There were but two rises in the river over 4 feet on mid tide, as stated heretofore. The long continuance of low stages is not unusual on James River, and in such periods some deposit is expected. There has been, however, no material change in the depth available for navigation from this source. In the first 4 miles below Richmond there appears to have been a slight scour and in 2 miles farther a deposit. There was a slight scour found at Varina Shoal and a deposit at Curles Neck. But the change in depth due to deposits within the regulation does not appear to exceed 0.1 foot. The channels in the regulated parts of the river are better in direction and are not impaired in depth.

The changes in width of regulation, the new dams, the repairs and extensions of others, and to some extent the extra height given to parts of dams mentioned heretofore have probably caused the slight scour on the first 4 miles, but the result is inconsiderable and an additional evidence that no material improvement in depth can be expected in the older parts of the regulation without further contraction or by elevation of the works. Higher rises in the river will give better vertical sections temporarily, and that is all that may be expected within 6 miles of Richmond.

The maintenance of the channel above the lower city line of Richmond has been under the direction of the James River Improvement Committee, and at the cost of the city.

History of the improvement.—The first appropriation by the Government for improvement of James River was made in 1852, and was supplemented by the city of Richmond. This was expended in removing the more dangerous rocks and maintaining deeper channels through the shallower bars.

The next appropriation by the Government was $50,000 in 1870. The city also appropriated $250,000, a large part of which was expended for dredges and other plant.

The first operations of the United States were removing the remains of military bridges and other obstructions, and in restoring the channel to its condition prior to 1861. The channel through Rocketts Reef was also widened and deepened and Dutch Gap Cut-off enlarged and opened to navigation. Some dikes were constructed within 2 miles of Richmond for regulation. The city force deepened and maintained the channels through the bars for 18 miles below.

In the winter and spring of 1873-74 a survey was made for about 20 miles of the river below the head of tide, giving sections of the river from 20 to 200 feet apart.

Depths for navigation.—The limiting depth for navigation to Richmond in 1870 was 7 feet (10½ feet at high tide) for 18 miles below, in a channel narrow and tortuous from obstructions, artificial and natural. The depth on Rocketts Reef was the same in 1861, but the bars below had been kept in better condition by dredging. About 14 feet could then be brought to Trents Reach, about 18 miles below, by the channel of that date. The shoal in Trents Reach had 8½ feet on it in 1853 and 7 feet in 1870, a shoaling probably due to the partial opening of the Cut-off in the latter part of the civil war.

The channel near Richmond had been much improved from conditions in 1861 when the survey of 1873-74 was made.

Projects of improvement.—The first project for the improvement was to secure 18 feet at full tide in a channel 180 feet wide. This included some dredging at Harrisons Bar, 37 miles below Richmond. Excavations in hard material and the width of regulation conformed to this project until 1879, when the project was amended, making the depth 18 feet at low tide below Warwick Bar, 5 miles from Richmond, leaving the depths above unchanged. This project included three shoals below Harrisons Bar, the lowest at Goose Hill Flats, 30 miles above the river mouth.

Dredging and regulation was done at several points in 1880-81 in accordance with this project.

In 1881 a survey of the river bed was made from Richmond to about 12 miles above the river mouth, authorized by an act of Congress, directing a report on the practicability and cost of deepening the channel to 25 feet at full tide. The survey included borings in the river bed to that depth or to rock. The report was submitted in 1882 and approved by Congress in 1884. The work has been prosecuted since in furtherance of that project.

Characteristics of James River.—The James at Richmond, the head of tide water, has received the drainage of more than 7,000 square miles, the larger part of which is mountainous. It has no lakes or natural ponds to serve as reservoirs, and is subject to rapid fluctuations. It carries a large amount of sediment and is rarely clear at Richmond. It was gauged above tide water at a very low stage in 1877 by the city engineer, who found its discharge to be 1,332 cubic feet per second. The discharge is probably largely under this for short periods. In great freshets, judging from fairly well known sections and observed slopes, the discharge is over 200,000 cubic feet.

Freshets.—The greatest rise on mean mid tide at Richmond of which there is authentic record was 26 88 feet, November 25, 1877. The average freshet for twenty-two years is 9½ feet. There have been five rises of over 20 feet since October 1, 1870, viz: 25.28 feet October 1, 1870, 26.88 feet November 1, 1877, 22.56 feet April 2, 1886, 23.44 feet June 2, 1889, and 20.76 feet August 2, 1889. The highest since 1889 was 16.45 feet, January 12, 1895.

Two great freshets previous to 1870 have been kept in memory, one in the seventeenth and one in the eighteenth century. The latter, from excellent authority, was about the height of the highest above mentioned, at Bremo, 69 miles above Richmond. There is no record of the height of either of these older freshets on tide water known to the writer.

Tides.—In the past five years the mean height of half tide at Richmond City line, omitting those 1.4 feet, the average, has been 1.02 feet above mean ocean level at Fort Monroe as determined by United States Coast and Geodetic Survey. The lowest half-month's level of this stage in this period was 0.389 above ocean in November, 1894. The range of tides varies inversely with the width of the river. At Fort Monroe the mean rise and fall is 2.54 feet (United States Coast and Geodetic Survey). It was found 1.90 at Jamestown and 3.48 at Dutch Gap in 1893-94. The United States Coast and Geodetic Survey gives City Point 2.8 feet. The mean of five years at Richmond has been 3.95 feet, omitting tides not affected by high winds or changes in surface, 1.4 feet, with a range in the past year of 4.07 feet.

In a low stage of the river, July 1 to 15, 1894, the range at Richmond averaged 4.55 feet, with the low tide 0.81 foot below the mean for five years.

Accepting the difference in levels found between Fort Monroe and Richmond to be correct, the low tide in Richmond is lower than the mean low tide at Fort Monroe whenever it falls 0.47 foot below the mean at Richmond. This occurred in twenty-three half months in the past five years, but in no half month was the mid tide less than 0.39 foot above the mean ocean level at Fort Monroe, as given above. The greater range in Richmond probably accounts for this.

Character of the river bed.—For 2½ miles below the city line the river bed at from 7 to 22 feet depths was ordinarily covered with coarse gravel, containing some large water-worn but not rounded bowlders. Above this was the usual river silt and below gneissic rock. The larger part of the rock is decomposed to the depth of the project, and can be removed with more or less difficulty without blasting. The strata of solid rock vary in thickness, and are not infrequently the full depth of the cutting. This rock passes under the level of 22 feet below low tide at the lower end of Richmond Bar, and, so far as known, does not reappear except in two places on the right bank, where the channel opposite is of ample width and depth.

For 20 miles below the bed is in material which is moved by currents, except in a few places where the underlying gravel is reached. The fluvial current has then mainly lost its force, except in great freshets, and tidal currents prevail, rarely exceeding 2½ feet per second. The river is properly an estuary.

Shoals which required deepening in 1870.—The conditions of several parts of the river which required deepening in 1870, for the project of improvement now in progress, and their conditions by the latest surveys, are shown in the following statement:

Locality.	Miles below Richmond.	Depth at mean low tide, 1870.	Depth at mean low tide by recent surveys.	Available depth at mean full tide, latest survey.	General character of the river bed.	Mode of improvement thus far.
		Feet.	*Feet.*	*Feet.*		
Rocketts Reef		7	14.5	18	Mainly rock	Dredging and blasting.
Goodes Rocks	1.5	11	18	22	do	Do.
Richmond Bar	2	7	18	22	Sand and gravel underlaid by rock at 16 to 22 feet.	Regulation dredging and blasting.
Randolph Flats	2.8	9	18	22	Sand, some gravel.	Regulation, some dredging.
Warwick Bar	4.5	12.5	18.2	22	do	Do.
Falling Creek	5.3	13	18.7	22.5	Sand	Regulation.
Wards Reach	8	16	21.2	24.8	do	Do.
Willis Reach	9.5	16	19.1	22.7	Sand, some gravel.	Do.
Kingsland Reach	10	13	21.1	24.6	Compact gravel	Regulation and dredging.
Ferry Reach	11	21	21.1	24.6	Sand	Regulation.
Trents Reach *a*	18	7	4	7.4	do	Nothing for 21 years.
Varina	15.3	13	18.4	21.8	Sand and mud	Regulation.
Deep Bottom	18	18	18.1	21.5	do	Do.
Curles Neck	20.5	15	18.2	21.4	Soft mud	Do.
Coxs Bar	23	16	30	32.8	do	Natural causes.
Bermuda Hundreds	30	15	21.4	24.2	do	Do.
City Point Bar	32	19	19.8	22.6	Sand and mud	Do.
Harrisons Bar	37	14	21	23.8	Sand, compact gravel.	Dredging.
Coggins Point	38	16	18	20.8	Soft mud	Do.
Dancing	59.5	18	18	20	do	Do.
Swans	64.5	17	18	20	Soft mud, with lumps.	Do.
Goose Hill Flats	71	15	18	20	Sand and mud	Do.
Tribbells Shoal	77.5	19	21	24.3	Soft mud	Nothing done.
Rocklanding Shoal	89	19	19			Do.

a Now avoided by Dutch Gap Cut-off, which saves over 5 miles of navigation.

The estimated quantities and cost.—In submitting the estimates three divisions were made of the river from the Richmond City line to Rocklanding Shoal, 89 miles below. The total length of channel with less than 25 feet at full tide, was as follows:

Division.	Miles.	Less than 25 feet at full tide.
First division, Richmond to Drewry Bluff	7	5.9
Second division, Drewry Bluff to City Point	25	4.8
Third division, City Point to Rocklanding Shoal	57	11.8
Total	89	22.5

The estimate of quantities and cost then submitted is now divided in four parts, by subdividing the first where rock in place fall below the limit of 25 feet at full tide, as follows:

Division.	Point to point.	Miles.	Earth.	Rock.	Dikes.	Estimated cost.
			Cubic yds.	*Cubic yds.*	*Linear feet.*	
1	Richmond to Richmond Bar	2.5	475,194	495,752	5,000	$2,477,865
2	Richmond Bar to Drewry Bluff	4.5	921,222	20,000	10,000	284,244
3	Drewry Bluff to City Point	25	1,359,026	16,000	16,000	367,608
4	City Point to Rocklanding Shoal	57	4,025,035	....	14,000	708,545
	Total	89	6,780,477	531,752	45,000	3,838,262

The amount of work done on these divisions and its cost between July, 1881, and June, 1893, has been as follows:

Division.	Point to point.	Miles	Earth.	Solid rock.	Dikes.	Cost.
			Cubic yds.	*Cubic yds.*	*Linear feet.*	
1	Richmond to Richmond Bar	2.5	444,297	58,973	8,044	$439,047
2	Richmond Bar to Drewry Bluff	4.5	803,565	1,115	39,107	296,151
3	Drewry Bluff to City Point	25	365.584	503	27,663	147,449
4	City Point to Rocklanding Shoal	57	326,412	....	....	37,484
	Total	89	1,939,858	60,591	74,814	920,131

In the preceding table "earth" includes all excavation except that classed "solid rock." Under dikes are included wing dams. The cost of wheeling is charged to cost of dikes. The cost does not include general supervision, inspection, surveys, miscellaneous and office expenses.

The total expenditure since June 30, 1881, has been as follows:

For plant and care of public property, less rent received	$27,084.34
For surveys, maps, and models	98,512.08
For inspection	45,640.83
For office expenses	76,536.22
For general and miscellaneous	19,481.84
For excavation and regulation	920,131.36
	1,187,386.67

The amount appropriated since July, 1881, including funds then available, has been $1,198,968.

The result shows about 27.4 per cent of the estimated excavation done and an excess of 66 per cent of dikes built, at less than 31 per cent of the estimated cost, all expenditures included, with any necessary repairs and maintenance.

By divisions the results are as follows:

	Per cent of work done.			Per cent of estimated cost.
	Earth.	Rock.	Dikes.	
First division	93.5	11.8	161.0	22.9
Second division	87.3	5.6	391.0	134.3
Third division	26.9	3.1	172.9	51.7
Fourth division	8.1	....	....	8.3

The per cent of estimated cost is on the total expenditure; the cost of administration, etc., given above, being divided in proportion to amount expended for work on the several divisions.

In his report of 1882 the engineer officer clearly indicates the substitution of regulating works to a much greater extent than was estimated in lieu of dredging in soft material, and this policy has been followed above City Point.

Experience on the James has shown dredging material readily moved by the currents to be of scarcely more than temporary advantage, and that mainly in disposing of material at an earlier day which would have been moved by works of regulation and in a permanent manner.

Without regulation channels dredged in such material are rapidly filled, and the shoal returns to its previous depth and section. It is not certain that tidal currents above City Point have had an appreciable effect between the works of regulation. They have probably diminished deposits of silt in low stages.

In the lower river, where tidal currents are alone available for maintenance and are stronger than above City Point, nothing has been done toward regulation except in the deposition of some dredged material. The length of the shoals and the wide waters in which they lie make the construction of such works costly.

The interests of navigation have warranted a much larger expenditure in the shallower reaches near Richmond, while a little over 8 per cent of the estimated cost below City Point has enlarged and maintained a channel which is at least 200 by 18 feet at low tide. It is not certain, however, that the full channel of the project, 400 by 25 feet at full tide, in certain shoals can be maintained without an expenditure in dredging which may exceed the interest on the cost of regulation works and their maintenance, which might render a large percentage of the dredging estimated unnecessary and ultimately produce a wider if not deeper channel than that of the project. On the other hand, some of the channels are through stiff clay or similar hard material not of recent deposition, in wide waters where there are subsidiary channels. In such cases the enlargement of the main channel to at least the full depth and width of the project, with a more direct course between deep waters above and below, ought to produce a more powerful tidal current and tend to maintenance. The dredged material could be deposited so as to confine the flow, and as the width between such banks would be 3,000 feet or more, protection against scour and the return of the deposited material to the channel would not be troublesome immediately, and might never become so. For either regulation or dredging the full channel at least $100,000 should be available and the work completed without interruption.

Results of the improvement.—The results of the improvement of James River are a channel with 18 feet depth at low tide from the sea to within 800 feet of the Richmond City line, in place of 14 feet to 18 miles below Richmond and 7 feet for the remaining distance in 1870, and a saving of over 5 miles of difficult navigation by the opening of Dutch Gap Cut-off.

A depth of 18 feet at high tide is available to the city line.

Very respectfully, your obedient servant,

H. D. WHITCOMB,
Assistant Engineer.

Lieut. Col. CHARLES J. ALLEN,
Corps of Engineers.

K 12.

PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

The river and harbor act of August 18, 1894, contained the following item:

> Protecting Jamestown Island from the encroachments of James River, ten thousand dollars, or so much thereof as may be necessary.

Abrasion of the shore of the island had been going on for years and had reached a condition that required checking if the old landmark was to be preserved. The injury has been caused by the action of the waves raised by the winds mainly in the broad stretch above. These waves undermined the banks. The worst winds are from northwest to west; next, those from southeast to south; but north and south winds are also hurtful.

The plan adopted was to build a wall faced with granite, laid without mortar, in front of the threatened part of the island, to grade and turf the bluff behind it, and to add several groins in front of the wall. This work was completed June 5, 1895, under contract dated December 26, 1894. Amount expended to June 30, 1896, inclusive, $9,174.92.

The soil of the island is light and easily moved. The funds did not admit of covering the front requiring protection with the kind of work desirable. Storms, especially those of the winter of 1895 and 1896, greatly damaged the protection work.

The river and harbor act of June 3, 1896, appropriated for this work as follows:

> Protecting Jamestown Island from the encroachments of James River, fifteen thousand dollars, or so much thereof as may be necessary.

Examination of the eroded front was made during the winter of 1896 and 1897, and a project for the application of the appropriation of 1896 was submitted in April following. The project was approved. No work of construction, however, was undertaken during the fiscal year, and for the reason that satisfactory arrangements were not perfected whereby working parties could go upon certain land the protection of the front of which would have constituted the principal part of the work.

Prior to commencing work of protecting the front of the island under the appropriation of 1894, the engineer officer then in charge secured a permit from the proprietors of said land authorizing him to enter upon the property and put upon it the materials for the necessary structure and then to put up the structure itself to protect the property from the washing of the river; and further, to use any wharves, roads, or other conveniences which he might require.

It was claimed, when the matter came up of continuing the work under the appropriation of 1896, that when the protection work was done under the appropriation of 1894 some of the contractors' men committed depredations upon the said property. The owners thereof were unwilling to take the risk of possible further experience of that nature, and in consequence desired to establish conditions as to workmen and teams occupying or traversing the land that this office could not agree to and which the assistant engineer in local charge considered would practically rule the men off the ground. After more or less correspondence and several interviews by the assistant and myself a map was prepared in October last, in this office, together with a form of permit that it was thought would be unobjectionable, and the two sent to the representative of the party owning the said land. They were not accepted, however, and the matter has remained unsettled. Further effort will be made early in the coming fiscal year to arrive at an understanding which will enable the work to be undertaken.

It should be said that the owner of the other piece of property that would probably be protected to a small extent gave the necessary permission to enter upon the land.

The length of bank requiring immediate protection is about 2,600 feet. The money available for protection work is as follows:

Balance from old appropriation	$725.55
Appropriation of 1896	15,000.00
Total	15,725.55

This sum affords about $6 per running foot of bank, and is inadequate for as thorough and solid a protection as desired.

The plan for the work, based upon the funds available and with a view to covering, if possible, the entire portion subject to erosion, contemplates regrading the bank and levee where necessary, bringing it to a regular and even slope, and covering it with a slope wall of good-sized stone laid in hydraulic mortar, the toe of the stone slope wall to be protected by riprap and concrete block, so far as the funds will admit of. It is possible that a further expenditure may be needed for reinforcement of the toe of the slope, but no estimate for it is rendered herein.

Money statement.

July 1, 1897, balance unexpended	$15,725.55
July 1, 1898, balance unexpended	15,725.55

Appropriations.

The following appropriations have been made:

August 18, 1894	$10,000
June 3, 1896	15,000
Total	25,000

K 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of schooner Kate Lawson in Urbana Creek, Virginia.—On July 16, 1897, this office was informed by indorsement on a letter addressed to the Chief of Engineers that the schooner *Kate Lawson* had sunk in Urbana Creek. An examination made during that month, in consequence of the information received, showed that the wreck lay on the left of the channel about 450 feet below the steamboat wharf; that the vessel was a wooden schooner, 64.5 feet long, 19.9 feet beam, and 5.8 feet depth of hold, and had a registered net tonnage of 46.36 tons. The vessel was 27 years old and was nearly worn out. She had no cargo and little, if any, ballast. She sank about June 1, 1897. The wreck lay in a depth of from 5 to 6 feet of water on a bottom of soft mud.

On August 5, 1897, a report upon the results of the examination was made to the Chief of Engineers and the removal of the wreck recommended, the estimated cost of removal being $250. This recommendation was approved, and on August 7, 1897, an allotment of $250 for removing the wreck was made from the indefinite appropriation of June 14, 1880, for removing sunken vessels or craft obstructing or endangering navigation. Under date of September 2, 1897, the usual notice by public advertisement was given to all persons interested in the vessel that if within thirty days they should not have signified their intention and have taken preliminary steps to remove the wreck it would be considered abandoned and derelict and would be removed by the United States in accordance with law. Proposals were also invited for the removal of the wreck, to be opened October 2, 1897. An abstract of the proposals received will be found appended to this report. The bids were regarded as too high and were rejected. It was thought that the wreck could be removed by the United States snag boat by hired labor within the estimate and allotment, and this method of removal was authorized. The snag boat was engaged during the fall of 1897 in borings for the survey for the proposed Memorial Bridge across the Potomac River at Washington, and this work was delayed until the close of the working season. The boat was laid up for the winter at Washington, D. C., with the intention of sending her to the Rappahannock River and Urbana Creek in the spring. The prospect of war with Spain made it absolutely necessary, however, to keep the snag boat in the Potomac River for certain work in connection with the defenses of Washington, so that up to the close of the fiscal year it had not been found practicable to remove the wreck. It is expected, however, to remove it during July or August of the coming fiscal year.

Abstract of proposals for removal of the wreck of the schooner Kate Lawson in Urbana Creek, Virginia, opened October 2, 1897, by Lieut. Col. Chas. J. Allen, Corps of Engineers.

Name.	Amount.	Remarks.
W. H. French, Norfolk, Va	$400	
Louis E. Brown, Baltimore, Md	500	No guarantee.
Jno. L. Mills, Camden, N. J	950	

APPENDIX L.

IMPROVEMENT OF NORFOLK HARBOR, VIRGINIA, AND ITS APPROACHES, AND OF RIVERS AND HARBORS IN SOUTHEASTERN VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

REPORT OF MAJOR THOS. L. CASEY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Harbor at Norfolk and its approaches, Virginia.
2. Western Branch of Elizabeth River, Virginia.
3. Nansemond River, Virginia.
4. Appomattox River, Virginia.
5. Harbor at Cape Charles City, Virginia.
6. Nandua Creek, Virginia.
7. Inland water route from Norfolk, Virginia, to Albemarle Sound, North Carolina.
8. Roanoke River, North Carolina.
9. Pasquotank River, North Carolina.
10. Removing sunken vessels or craft obstructing or endangering navigation.

United States Engineer Office,
Norfolk, Va., July 19, 1898.

General: I have the honor to transmit herewith my annual report upon the works of river and harbor improvement in my charge during the fiscal year ended June 30, 1898.

Very respectfully, your obedient servant,

Thos. L. Casey,
Captain, Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

L 1.

IMPROVEMENT OF HARBOR AT NORFOLK AND ITS APPROACHES, VIRGINIA.

No work of improvement has been done during the fiscal year ended June 30, 1898.

Bids for the removal of the masonry abutment in the Eastern Branch of the Elizabeth River were opened July 9, 1897. All of the proposals were greater than the amount reserved for the work and were rejected by authority of the Chief of Engineers, each bidder being notified of such action by letter on July 20, 1897. An abstract of the proposals received is appended.

The expenditures during the fiscal year ended June 30, 1898, amounted to $4,444.02 for running and maintenance of steamer *Lucerne* and office expenses.

The commerce of the harbor, as reported for the calendar year 1897, is given in tabulated form below.

Norfolk Harbor is in the collection district of Norfolk and Portsmouth, and Norfolk, Va., is the nearest port of entry. Nearest light-house is Craney Island Light, at mouth of Elizabeth River, Virginia. Nearest fort, Fort Monroe, Va.

Amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1898, $23,548.07.

Money statement.

July 1, 1897, balance unexpended	$8,163.24
June 30, 1898, amount expended during fiscal year	4,444.02
July 1, 1898, balance unexpended	3,719.22

Amount (estimated) required for completion of existing project	56,774.56
Amount that can be profitably expended in fiscal year ending June 30, 1900	56,774.56

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

August 14, 1876	$35,000	August 11, 1888	$50,000
June 18, 1878	50,000	September 19, 1890	150,000
March 3, 1879	75,000	July 13, 1892	150,000
June 14, 1880	50,000	August 18, 1894	100,000
March 3, 1881	75,000	June 3, 1896	100,000
August 2, 1882	75,000		
July 5, 1884	25,000	Total	985,000
August 5, 1886	50,000		

Abstract of bids for removing masonry abutment in Eastern Branch of Elizabeth River, Virginia, received in response to public notice dated June 22, 1897, opened by Capt. Thos. L. Casey, Corps of Engineers, July 9, 1897.

No.	Name and address of bidder.	Removal of whole of said abutment.	Removal of stone in said abutment only.	Removal of foundation and substrata only.	Remarks.
1	Nannie H. Baker, Berkley, Va	$6,015.00	$1,325.00	$4,690.00	Lowest.
2	Arthur G. Anthony, Norfolk, Va		1,500.00		
3	Chester T. Caler, Norfolk, Va	6,943.26		6,413.26	

Amount available from appropriation for improving harbor at Norfolk and its approaches, Virginia, act of June 3, 1896, for removal of masonry abutment, $3,500.

All bids rejected by authority of the Chief of Engineers, United States Army.

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the harbor at Norfolk, Va., during the calendar year 1897, were compiled from statements furnished by parties making shipments over this waterway:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Coal	3,505,963	$12,270,850	Steam	4,037	17	1,712
Cotton	58,609	7,033,110	Sail	1,623	14	615
Lumber	798,767	7,084.055	Barges	11,912	9	641
Fertilizer	58,962	924,730	Lighters	622	3	55
Ice	34,000	79,500	Rafts	328		
Miscellaneous	4,974,225	300,429,169				
Total	9,430,526	327,821,414		18,522		

Approximate amount of freight of all kinds shipped and received by water.

	Tons.		Tons.
1888	1,914,506	1893	3,584,727
1889	2,243,087	1894	4,545,049
1890	2,384,841	1895	5,013,185
1891	2,931,751	1896	5,986,636
1892	3,427,189	1897	9,430,526

L 2.

IMPROVEMENT OF WESTERN BRANCH OF ELIZABETH RIVER, VIRGINIA.

Dredging under the contract with P. Sanford Ross, of Jersey City, N. J., dated November 7, 1896, in progress at the close of the fiscal year 1897, was carried on until August 25, 1897, when the channel projected for the improvement was completed.

During the fiscal year 103,996 cubic yards of material was removed and deposited behind the ripraps in Hampton Roads, a distance of about 12 miles from the work. From this removal of material three cuts, each 40 feet wide and 1,500 feet long, and one cut of the same width and 1,160 feet long, resulted. The point at the entrance from the Norfolk Harbor channel was also cut back a distance of 200 feet.

The improved channel, which has been completed in accordance with the project, is about 1 mile in length, extending from the 20-foot depth in Norfolk Harbor to within 300 feet of the bridge crossing the river between Port Norfolk and West Norfolk. Its width is 200 feet, with the exception of the inner 1,500 feet, which was dredged to a width of 320 feet to facilitate the turning of boats at West Norfolk, and at the entrance from Norfolk Harbor, where a point was cut back 200 feet to allow of easier ingress to the channel. The depth obtained throughout was 20 feet at mean low water.

The cost of the improvement may be stated as follows:

Removing and depositing 482,033 cubic yards of material (mud mingled with sand and oyster shells), at $0.084	$40,490.78
Inspection	954.80
Superintendence, office expenses, and contingencies	2,973.15
Total	44,418.73

The small balance available is being reserved for the purpose of making an examination of the channel, when an opportunity offers, to determine whether it is liable to deterioration as is anticipated.

A large portion of the commerce of the river is carried in small sailing vessels, which bring down produce from the large truck farms adjoining the river for shipment north. It is impossible to collect statistics of the amount of commerce carried in these vessels. They are all of small draft, and used the river before the channel was improved. The channel has been of benefit to vessels going to West Norfolk, and the extent of the commerce to and from that place is exhibited in tabulated form below.

This river is in the collection district of Norfolk and Portsmouth, Va., and Norfolk, Va., is the nearest port of entry. Nearest light-house, Craney Island Light, at the mouth of Elizabeth River, Virginia. Nearest fort, Fort Monroe, Virginia.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1898, is $23,548.07.

Money statement.

July 1, 1897, balance unexpended	$17,247.50
June 30, 1898, amount expended during fiscal year	16,666.23
July 1, 1898, balance unexpended	581.27

Appropriation.

June 3, 1896	$45,000

Contract in force.

Name and residence of contractor.	Date of approval of contract.	Date of beginning work.	Date of expiration.
P. Sanford Ross, 277 Washington street, Jersey City, N. J.	Nov. 12, 1896	Dec. 14, 1896	Aug. 25, 1897

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Western Branch of the Elizabeth River, Virginia, during the calendar year 1897 were kindly furnished by Mr. Charles O. Hains, general manager of the Atlantic and Danville Railroad.

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Coal	1,866	$5,800	Steam	6	9	190
Guano	300	4,800	Sail	301	10	300
Forest products	161,696	1,130,844	Barges	1,346	11	290
Miscellaneous	80,941	20,790,700	Lighters	46	8	600
Total	244,803	21,932,144		1,699		

Approximate amount of freight of all kinds shipped and received by water.

	Tons.
1896	211,653
1897	244,803

L 3.

IMPROVEMENT OF NANSEMOND RIVER, VIRGINIA.

No work of improvement has been done during the fiscal year ended June 30, 1898. The balance available is being retained until a sufficient amount of funds may be available to undertake work of a permanent nature. No complaints having been received during the year, the channels are probably in good navigable condition.

The expenditures during the fiscal year ended June 30, 1898, amounted to $12.50 for office expenses.

Nansemond River is in the collection district of Norfolk and Portsmouth, and Norfolk, Va., is the nearest port of entry. Nearest light-house, Pig Point Light, at mouth of river. Nearest fort, Fort Monroe, Va.

The amount of revenue collected at the port of Norfolk, Va., during the fiscal year ended June 30, 1898, is $23,548.07.

Money statement.

July 1, 1897, balance unexpended	$4,917.13
June 30, 1898, amount expended during fiscal year	12.50
July 1, 1898, balance unexpended	4,904.63
Amount (estimated) required for completion of existing project	107,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

March 3, 1873	$15,000	September 19, 1890	$10,000
March 23, 1874	10,000	July 13, 1892	10,000
March 3, 1875	5,000	August 18, 1894	10,000
March 14, 1876	5,000	June 3, 1896	5,000
June 18, 1878	2,000		
August 11, 1888	10,000	Total	82,000

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Nansemond River, Virginia, during the calendar year 1897 were compiled from statements furnished by parties making shipments by way of this stream:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Coal, ice, and plaster	4,500	$12,000	Steam	312	7	250
Lumber	31,355	156,775	Sail	132	11	260
Miscellaneous	7,645	382,250				
Total	43,500	551,025		444		

Approximate amount of freight of all kinds shipped and received by water.

	Tons.		Tons.
1888	109,900	1894	53,762
1890	217,738	1895	59,701
1891	78,572	1896	61,405
1892	133,723	1897	43,500
1893	59,473		

L 4.

IMPROVEMENT OF APPOMATTOX RIVER, VIRGINIA.

No work of improvement has been done during the fiscal year ended June 30, 1898.

The tugboat, two scows, and all miscellaneous property belonging to the improvement were removed from Petersburg, Va., and taken to Fort Monroe, Va. The tugboat and scows were condemned and destroyed.

The expenditures have been for the care of the plant while at Petersburg, Va.

The balance available for the improvement is being held in reserve for the removal, when necessary, of shoals formed by freshets, as it is not large enough to undertake any work toward the permanent improvement of the stream.

Commercial statistics for the calendar year 1897 are presented below.

This river is in the collection district of Petersburg, Va., which is the nearest port of entry. Nearest light-house, Jordan Point Light, in the James River, Virginia. Nearest fort, Fort Monroe, Va.

Money statement.

July 1, 1897, balance unexpended	$4,590.66
June 30, 1898, amount expended during fiscal year	472.12
July 1, 1898, balance unexpended	4,118.54
Amount (estimated) required for completion of existing project	48,090.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	30,000.00
For maintenance and repairs during fiscal year ending June 30, 1900	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

March 3, 1871	$50,000	August 2, 1882	$35,000
June 10, 1872	40,000	July 5, 1884	25,000
March 3, 1873	30,000	August 5, 1886	18,750
June 23, 1874	30,000	August 11, 1888	15,000
March 3, 1875	30,000	September 19, 1890	15,000
August 14, 1876	30,000	July 13, 1892	15,080
June 18, 1878	30,000	August 18, 1894	5,000
March 3, 1879	20,000	June 3, 1896	5,000
June 14, 1880	20,000		
March 3, 1881	20,000	Total	433,830

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the Appomattox River, Virginia, during the calendar year 1897, were furnished by Mr. W. H. Mays, harbor master, Petersburg, Va.:

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
General merchandise	35,305	$247,134	Steam	895	6.5	175
Fertilizer	13,011	146,048	Sail	457	8.5	160
Coal	4,613	21,065	Barges	66	8	280
Peanuts	1,136	87,731				
Miscellaneous	29,966	155,768				
Total	84,031	657,746		1,418		

Approximate amount of freight of all kinds received and shipped by water.

	Tons.		Tons.
1888	30,626	1892	25,218
1889	26,121	1896	81,318
1890	21,693	1897	84,031
1891	26,275		

L 5.

IMPROVEMENT OF HARBOR AT CAPE CHARLES CITY, VIRGINIA.

No work has been done on this improvement during the fiscal year ended June 30, 1898.

The storm of October 23–25, 1897, washed the oyster shells from under the riprap covering of the inner 450 feet of the jetty constructed on the north side of the channel, causing it to settle over that distance. This was the part of the jetty built by the New York, Philadelphia and Norfolk Railroad Company without expense to the United States.

Cape Charles City Harbor is in the collection district of Cherrystone, Va., and Cape Charles City, Va., is the nearest port of entry. Fort Monroe, Va., is the nearest fort and the nearest light-house is Cherrystone Light.

Money statement.

July 1, 1897, balance unexpended	$92.54
June 30, 1898, amount expended during fiscal year	75.00
July 1, 1898, balance unexpended	17.54
Amount (estimated) required for completion of existing project	107,340.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	40,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

By act approved—

September 19, 1890	$25,000
July 13, 1892	10,000
Total	35,000

COMMERCIAL STATISTICS.

No replies were received to the inquiries made in regard to the commerce of this harbor during the calendar year 1897.

Approximate amount of freight of all kinds shipped and received by water.

	Tons.		Tons.
1890	390,207	1894	427,723
1891	319,164	1895	455,269
1892	341,269	1896	487,004
1893	393,352		

L 6.

IMPROVEMENT OF NANDUA CREEK, VIRGINIA.

No operations were undertaken during the fiscal year ended June 30, 1898, the Secretary of War having decided to take no action toward expending the funds appropriated in the act of June 3, 1896, for the improvement of the creek.

The expenditures during the fiscal year ended June 30, 1898, amounted to $11.92, for making an inspection of the creek.

Nandua Creek is in the collection district of Cherrystone, Va.; and Cape Charles City, Va., is the nearest port of entry. Fort Monroe, Va., is the nearest fort, and the nearest light-house is Cherrystone Light.

Money statement.

July 1, 1897, balance unexpended	$3,000.00
June 30, 1898, amount expended during fiscal year	11.92
July 1, 1898, balance unexpended	2,988.08
Amount (estimated) required for completion of existing project	3,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

Appropriation.

June 3, 1896	$3,000

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of Nandua Creek, Virginia, during the calendar year 1897, were furnished by Mr. John S. Wilson, president of the Baltimore, Chesapeake and Atlantic Railroad Company:

Articles.	Amount.	Value.
	Tons.	
Potatoes	2,540	$47,625
Lumber	175	1,750
Oysters	378	6,467
Fertilizer	50	1,500
Miscellaneous	293	7,911
Total	3,436	65,253

No information as to the vessels handling the commerce of the creek could be obtained.

Approximate amount of freight of all kinds shipped and received by water.

	Tons.
1896	6,125
1897	3,436

L 7.

IMPROVEMENT OF INLAND WATER ROUTE FROM NORFOLK, VIRGINIA, TO ALBEMARLE SOUND, NORTH CAROLINA, THROUGH CURRITUCK SOUND.

Dredging was carried on during the fiscal year ended June 30, 1898, from February 21, 1898, to April 29, 1898, under a contract with Chester T. Caler, of Norfolk, Va., dated July 29, 1897, in the vicinity of the Albemarle and Chesapeake Canal locks and in the sharp bend near the Green Sea Railroad wharf in the Southern Branch of the Elizabeth River.

The plant used on the work by the contractor consisted of one dipper dredge, three scows, and one tugboat, which removed 29,062 cubic yards of material between the dates given above. The material, which was fine sand mixed with mud, was deposited from scows at high water on the flats above the Norfolk and Western Railroad bridge, the average distance of towing being about 10 miles for the round trip. The contract price for the work was 23 cents per cubic yard, scow measurement.

The dredging from the canal locks was carried over a distance of 1,700 feet and width of 60 feet and for a further distance of 1,300 feet one cut 20 feet in width was made on each side of the channel then existing. In the bend at the Green Sea Railroad wharf one cut was made on each side of the existing channel for a distance of 1,900 feet. The depth obtained was 9 feet at mean low water.

The work done was in the nature of redredging, to maintain the projected channel width, and was necessary to render navigation easier for the tows of lumber barges using this part of the route.

This work is in the collection districts of Norfolk and Portsmouth, Va., and Albemarle, N. C.; and Norfolk, Va, and Edenton, N. C., are the nearest ports of entry. Nearest light-house, Long Point Light in Coanjock Bay, North Carolina. Fort Monroe, Va., is the nearest fort.

The amount of revenue collected at the ports of Norfolk, Va., and Edenton, N. C., during the fiscal year ended June 30, 1898, is $23,548.07 and $———, respectively.

Money statement.

July 1, 1897, balance unexpended	$8,887.43
June 30, 1898, amount expended during fiscal year	7,418.06
July 1, 1898, balance unexpended	1,469.37
Amount (estimated) required for completion of existing project	29,667.08
Amount that can be profitably expended in fiscal year ending June 30, 1900	20,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

For Southern Branch, Elizabeth River, Virginia—	
March 3, 1873	$15,000
June 23, 1874	10,000
March 3, 1875	5,000
August 14, 1876	5,000
June 18, 1878	5,000
For North Landing River, Virginia and North Carolina—	
March 3, 1879	25,000
June 14, 1880	15,000
March 3, 1881	7,500
August 2, 1882	8,000
For Currituck Sound, Coanjock Bay, and North River Bar, North Carolina—	
June 18, 1878	20,000
For Carrituck Sound, Coanjock Bay, and North River Bar, North Carolina—Continued.	
March 3, 1879	$25,000
June 14, 1880	25,000
March 3, 1881	30,000
August 2, 1882	20,000
July 5, 1884	5,000
August 5, 1886	10,000
August 11, 1888	7,500
For Inland water route, etc.—	
September 19, 1890	10,000
July 13, 1892	9,000
August 18, 1894	10,000
June 3, 1896	10,000
Total	277,000

NOTE.—Amount received from sale of property to other works, $2,169.69.

Abstract of contracts in force.

Name and residence of contractor.	Date of approval of contract.	Date of beginning work.	Date of expiration.
Chester T. Caler, Norfolk, Va	Aug. 12, 1897	Feb. 21, 1898	Apr. 29, 1898

COMMERCIAL STATISTICS.

The following statistics relative to the commerce of the inland water route from Norfolk Harbor, Virginia, to Albemarle Sound, North Carolina, during the calendar year 1897, were compiled from a statement furnished by the Albemarle and Chesapeake Canal Company.

Articles.	Amount.	Value.	Vessels.	Number.	Average draft.	Average tonnage.
	Tons.				*Feet.*	
Lumber	258,798	$2,587,980	Steam	3,014	6.5	85
Guano	13,489	1,348,900	Sail	1,460	5.5	46
Coal	8,470	42,350	Barges	1,266	6	175
Cotton	1,131	158,340	Lighters	118	4	100
Fish	851	42,550	Rafts	251		
Ice	470	1,880				
Miscellaneous	17,846	2,676,900				
Total	301,055	6,858,900		6,109		

Approximate amount of freight of all kinds passing through this route.

	Tons.		Tons.
1888	335,758	1893	296,520
1889	372,617	1894	285,455
1890	403,111	1895	324,866
1891	328,609	1896	322,947
1892	281,542	1897	301,055

L 8.

IMPROVEMENT OF ROANOKE RIVER, NORTH CAROLINA.

Operations on this improvement during the fiscal year ended June 30, 1898, have been confined to the patrol of the river by the snag boat *Roanoke*, and the removal, by this means, of obstructions lodged in the channel by freshets and bank slides. The boat was in service on the river during July, 1897, and from December 1, 1897, to March 31, 1898, and removed 116 trees, 13 logs, 19 stumps, and 11 snags from the channel and bank slides and trimmed 13 trees overhanging the channel.

An effort was made to secure a full report of the commerce during the calendar year 1897, but without avail. The amount of commerce on the stream is thought to have been about the same as in 1896, of which a full statement was not obtainable.

The expenditures during the fiscal year have been for removing obstructions, repairs to the snag boat performed by the crew, and office expenses.

No further appropriation seems justifiable at present. The available balance is sufficient to keep the river in a navigable condition for its present commerce.

This river is in the collection district of Albemarle, N. C., and Edenton, N. C., is the nearest port of entry. Nearest light-house, Roanoke River Light, North Carolina, at mouth of river. Nearest fort, Fort Monroe, Va.

Money statement.

July 1, 1897, balance unexpended	$39,541.51
June 30, 1898, amount expended during fiscal year	3,847.50
July 1, 1898, balance unexpended	35,694.01
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	41,000.00

Appropriations.

March 3, 1871	$20,000	August 11, 1888	$40,000
June 10, 1872	10,000	September 19, 1890	25,000
March 3, 1873	10,000	July 13, 1892	50,000
June 23, 1874	5,000	August 18, 1894	30,000
August 2, 1882	5,000	June 3, 1896	10,000
July 5, 1884	3,000		
August 5, 1886	20,000	Total	228,000

NOTE.—Amount received from sale of property to other works, $1,338.

COMMERCIAL STATISTICS.

Only two replies to the inquiries made in regard to the commerce of this stream during the calendar year 1897 were received, their aggregate being 20,076 tons.

Approximate amount of freight of all kinds received and shipped by water.

	Tons.		Tons.
1870	150,000	1892	42,039
1890	182,700	1893	121,024
1891	376,181		

L 9.

IMPROVEMENT OF PASQUOTANK RIVER, NORTH CAROLINA.

Authority was secured July 22, 1897, for the expenditure of the available balance of funds for this improvement, in trimming trees on points and removing obstructions from the channel between the lower terminus of Turners Cut and a point 3½ miles below.

The snag boat *Roanoke* was sent to the river to perform this work on August 8, 1897, and continued at work until November 30, 1897, when the funds were exhausted. During that time, 167 cords of brush were cut from trees at points between Opossum Quarter and the mouth of Turners Cut, 9 logs and 5 trees removed from the channel in the vicinity of the former, and 23 logs, 6 piles, and 8 stumps taken from the channel of the Moccasin Track.

In the operation of trimming, each point was cleared far enough back to afford a clear view of the succeeding reach of the river. The cost of the work was $1,949.72.

It is impossible to secure an accurate statement of the amount of commerce benefited by the improvement of that part of the river covered by the project, as it is carried on in pole or flat boats, which are small and their trips are infrequent. Cord wood is probably transported in greater quantity than any other article, being brought down in flatboats, and occasionally a schooner load is towed out of the river by tugs. Two small steamers make two trips a week each from Elizabeth City through Turners Cut to South Mills, carrying products of the farms adjoining the river.

This work is in the collection district of Albemarle, N. C., and Edenton, N. C., is the nearest port of entry. Nearest light-house, Wade Point Light, at mouth of river. Fort Monroe, Va., is the nearest fort.

Money statement.

July 1, 1897, balance unexpended	$2,403.02
June 30, 1898, amount expended during fiscal year	2,398.45
July 1, 1898, balance unexpended	4.57

Appropriations.

March 2, 1829	$80
September 19, 1890	3,000
July 13, 1892	3,000
August 18, 1894	1,000
Total	7,080

NOTE.—Amount turned in to surplus fund of the Treasury, $32.75.

L 10.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of steamer Wyanoke.—A description of the vessel and a statement of the work performed by the contractor to June 30, 1897, may be found on pages 1379 and 1380, Annual Report of the Chief of Engineers, United States Army, Part II, 1897.

Work on the wreck was completed May 15, 1898, after blowing it to pieces and removing the débris.

During the fiscal year two unsuccessful attempts were made to raise the wreck with inflated air bags, 134 of which had been placed within the hull and separately connected to receivers distributed about the deck of the vessel. The first attempt was made October 31, 1897, when air was forced into the sacks for a period of seven hours from two large compressors located on two tugs, one of which was anchored at the bow of the wreck and the other at the stern. The second was made on January 28, 1898, after work had been suspended for two months. No additional sacks were placed. This time air was forced in the sacks for twenty-four hours, and in addition a powerful tug was made fast to the bow of the vessel in an endeavor to break the suction.

On February 10, 1898, work was commenced in blowing the wreck to pieces, and this was accomplished in a very short time by the explosion of five tons of dynamite in charges of from 700 to 50 pounds. While this work was going on a small schooner was employed from which to carry on operations and for the storage of explosives.

After demolishing the wreck a derricked barge was engaged to raise the débris, which amounted to about 900 tons, and was discharged from the barge to a dock at Newport News, Va.

The final examination of the locality showed a depth of from 55 to 65 feet at mean low water. No obstruction which would interfere with the anchorage of vessels in the vicinity was found.

The removal of this wreck cost $17,811.32, $15,771.50 of which was paid the contractor, $1,228.67 for inspection, and $592.65 for office expenses and contingencies.

Wreck of steamer Helen Smith.—A description of the vessel and locality at which sunk may be found in the Annual Report of the Chief of Engineers, Part II, page 1380.

The bid of William T. White for the removal of the wreck at $100.50 was accepted, and he raised the wreck by pontoons with the intention of taking it into shoal water. After it had been towed a short distance the chains slipped from the hull and the wreck went down in 25 feet of water. Work was then abandoned by him and the next lowest bidders, Briton & Wilson, were authorized to undertake the work at the price bid by them, viz, $138.38. After they had attempted to raise the wreck by means of empty oil barrels submerged and fastened to the hull they resorted to the use of dynamite, and had destroyed the wreck on October 15, 1897.

The cost of the work was $205.88, which was expended during the fiscal year.

Wreck of schooner A. D. Lamson.—The *A. D. Lamson* was a three-masted wooden schooner 133 feet long, 33.1 feet beam, 9.5 feet deep, and gross tonnage of 448.15. She collided with the steamship *Rappahannock* and sank in about 31 feet of water 6 miles E. by N. from Cape Henry Light-house.

The wreck was a dangerous obstruction to navigation. Its removal was authorized August 23, 1897, $1,000 being allotted for the work. This amount was subsequently increased to $1,500.

Verbal offers were obtained for the removal of the wreck by blasting from local wrecking firms, and Mr. Henry Seymour was engaged to do the work for $1,500.

The work was commenced October 3, 1897, and completed November 4, 1897. The cost of the work was $1,500, all of which was expended during the fiscal year.

Wreck of schooner Walker Armington.—The removal of this wreck, which was in 29 feet of water S. 68° 31′ E. (magnetic) from Thimble Shoal Light and 2½ miles distant therefrom, was authorized December 2, 1897, at a cost of $3,500.

The vessel was a four-masted wooden schooner of gross tonnage of 913.

After proposals had been invited by public notice, a contract was made with the lowest bidders, Virden & Ross, of Lewes, Del., to remove the wreck by demolition. The work was accomplished between January 13, 1898 and February 4, 1898.

The cost of the work was $3,191.13, $2,900 of which was paid the contractor for removing the wreck.

Abstract of proposals for removing the wreck of the schooner Walker Armington, in Chesapeake Bay, Virginia, received in response to public notice dated December 6, 1897; opened by Captain Thos. L. Casey, Corps of Engineers, at Norfolk, Va., on December 14, 1897.

No.	Name and address of bidder.	Price bid.	Remarks.
1	Henry Seymour, Norfolk, Va	$4,000	
2	William H. Virden and John C. Ross, Lewes, Del., *a*	2,900	Lowest bid.
3	W. H. French, Norfolk, Va	3,950	
4	D. S. Baum, Norfolk, Va	3,870	

a Contract entered into January 1, 1898.

Amount available for removal of wreck of schooner "*Walker Armington,*" $3,500.

Abstract of contracts in force.

Name and residence of contractor.	Date of approval of contract.	Date of beginning work.	Date of Expiration.
Andrew J. Cooper, New York, N. Y	Dec. 16, 1896	Mar. 9, 1897	May 15, 1898
Virden & Ross, Lewes, Del	Jan. 13, 1898	Jan. 13, 1898	Feb. 4, 1898

APPENDIX M.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA.

REPORT OF CAPT. W. E. CRAIGHILL, CORPS OF ENGINEERS, OFFICER IN CHARGE FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Ocracoke Inlet, North Carolina.
2. Fishing Creek, North Corolina.
3. Pamlico and Tar rivers, North Carolina.
4. Contentnia Creek, North Carolina.
5. Trent River, North Carolina.
6. Neuse River, North Carolina.
7. Inland waterway between Newbern and Beaufort, North Carolina.
8. Harbor at Beaufort, North Carolina.
9. Inland waterway between Beaufort and New River, North Carolina.
10. New River, North Carolina.
11. Black River, North Carolina.
12. North East (Cape Fear) River, North Carolina.
13. Cape Fear River above Wilmington, North Carolina.
14. Cape Fear River at and below Wilmington, North Carolina.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., July 19, 1898.

GENERAL: I have the honor to submit herewith * * * my annual report for the year 1898 * * * .

Very respectfully, your obedient servant,

W. E. CRAIGHILL,
Captain, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

M 1.

IMPROVEMENT OF OCRACOKE INLET, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects, see Annual Report, Chief of Engineers for 1896, page 1097.

At the beginning of the fiscal year it was found that the Royal Shoal Cut was maintaining its depth, but the Beacon Island Slough Cut had filled so that the greatest depth was 8.7 feet for a width of but 75 feet, and on the northern edge the shoaling amounted to as much as 2 feet.

No complaints on account of diminished depth had been made from vessels using the channels.

During the year a survey has been made of both dredged cuts. Royal Shoal Cut has shoaled some, principally on the sides. The amount of shoaling is about 29,000 cubic yards. Its average depth is four-tenths of a foot less than in June, 1897; least available depth now is 8.6 feet at mean low water.

Beacon Island Slough Cut has nearly completely shoaled, so that the conditions there are about the same as before dredging. Least available depth at mean low water is 7 feet.

The problem of the maintenance of Beacon Island Slough channel has been under consideration, but on account of the difficulty of accomplishing the required results with an expenditure justified by the amount of commerce, no satisfactory solution has yet been found.

This inlet is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1897, balance unexpended	$17,383.03
June 30, 1898, amount expended during fiscal year	1,093.59
July 1, 1898, balance unexpended	16,289.44
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	(*)

Ocracoke Inlet, North Carolina.

Appropriated—	
March 20, 1826, to March 3, 1837	$133,750.00
September 19, 1890	90,000.00
July 13, 1892	15,000.00
	238,750.00
Less amount carried to surplus fund	17.60
	238,732.40

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Hay	150	Shingles	1,000
Oysters	3,000	Fertilizers	1,000
Clams	2,000	Coal	2,500
Turpentine, spirits	1	General merchandise	440
Wood	150		
Lumber	33,500	Total	43,741

Number of passengers, 1,000. Decrease over last year, 6,259 tons.

Freight transported.

Calendar year ending December 31—		
1890, estimated	tons..	15,000
1891, estimated	do...	15,000
1892		(†)
1893		(†)
1894		(†)
1895, estimated	tons..	30,223
1896, estimated	do...	50,000

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* Present available balance sufficient should it become necessary to maintain the project depth (which was obtained in preceding fiscal year) by redredging.

† Not estimated.

Statement of vessels navigating Ocracoke Inlet, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	No.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Schooners	23	2,913	6 to 11	131

M 2.

IMPROVEMENT OF FISHING CREEK, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects, see Annual Report Chief of Engineers for 1896, page 1100.

In December, 1896, the provision of the appropriation act that the money should not be available until draws were provided in the bridges that were unreasonable obstructions to navigation had been complied with, and work by hired labor and the use of the United States plant was then commenced.

At the beginning of the fiscal year the creek had been cleared for 12 miles, commencing at its mouth.

The work during the year has consisted of removing snags and logs from the channel and clearing overhanging trees from the banks.

There have been removed from the channel 6,653 large snags, 346 stumps, 560 trees, and 44¾ cords small snags, and from the banks 623 trees hauled back, 91 trees trimmed, and 134 cords brush cut.

The creek has been cleared from the 12-mile post to 19½-mile post, completing the work for this distance, 49.5 per cent of the whole amount.

This creek is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1897, balance unexpended	$9,314.45
June 30, 1898, amount expended during fiscal year	6,686.29
July 1, 1898, balance unexpended	2,628.16
July 1, 1898, outstanding liabilities	62.50
July 1, 1898, balance available	2,565.66
Amount (estimated) required for completion of existing project	7,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	* 10,750.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriated.

September 19, 1890	$10,000
July 13, 1892	5,000
Total	15,000

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* $3,000 included for maintenance.

COMMERCIAL STATISTICS.

Year ending December 31, 1897.

Class of goods.	Tons.
Timber	2,400
Fertilizer	60
Total	2,460

Gain over last year, 1,460 tons. Transportation lines established during the year none.

Freight transported.

Calendar year ending December 31, 1896	tons	1,000

Statement of vessels navigating Fishing Creek, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamer	1	15	2
Flats	1	50	1.5

M 3.

IMPROVEMENT OF PAMLICO AND TAR RIVERS, NORTH CAROLINA.

[One river, called the Pamlico below and the Tar above Washington.]

For previous history of this improvement and detailed statements of projects, see Annual Report of Chief of Engineers for 1896, page 1101.

The operations during the year ending June 30, 1898, have been carried on by hired labor and use of the United States plant.

Obstructions were removed from the river above Washington to Dunbar's bridge (73 miles), as follows: From the channel, 1,575 snags, 86 logs, 328 stumps, 539 trees, and 32½ cords small snags; and from the banks, 201 trees hauled back, 52 trees trimmed, and 14 cords brush cut.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1897, balance unexpended	$5,140.93
June 30, 1898, amount expended during fiscal year	3,854.20
July 1, 1898, balance unexpended	1,286.73
Amount (estimated) required for completion of existing project	*38,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	44,500.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

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* $3,000 annually for cost of maintenance and snagging not included.

Appropriated for Pamlico and Tar rivers, North Carolina.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838	$10,000	$10,000	July 5, 1884	$5,000	53,000
			August 5, 1886	5,000	58,000
August 14, 1876	15,000	15,000	August 11, 1888	10,000	68,000
May 3, 1879	6,000	21,000	September 19, 1890	10,000	78,000
June 14, 1880	9,000	30,000	July 13, 1892	10,000	88,000
March 3, 1881	8,000	38,000	August 18, 1894	10,000	98,000
August 2, 1882	10,000	48,000	June 3, 1896	5,000	103,000

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	4,930¼	Oysters	495
Cotton seed	3,450	Rosin	42
Cotton-seed meal	524	Turpentine:	
Tobacco, leaf	13½	Crude	150
Rice	140	Spirits	12
Grains	12,000	Wood	1,880
Hay	5,000	Timber	137,592
Potatoes	8,186	Lumber	133,991
Vegetables	103	Shingles	342
Cattle	46¾	Fertilizers	18,000
Horses	20	Coal and minerals	5,200
Hogs	40	General merchandise	30,057
Poultry	9½	Machinery	3
Eggs	100		
Fish	611¼	Total	363,513¼
Cotton-seed oil	575		

Number of passengers, 12,671.

Gain since last year, 111,625¾ tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1875	21,000	1893	119,505
1890	277,832	1894	119,979
1891	195,600	1895	183,226¾
1892	107,097	1896	251,887½

Statement of vessels navigating Pamlico and Tar rivers, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers and steam tugs	26	1,416.89	3 to 9
Barges	38	8,554.37	6 to 7
Sloops, schooners, etc	86	1,766.67	2½ to 7½

M 4.

IMPROVEMENT OF CONTENTNIA CREEK, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1103.

The operations of the year have been carried on by hired labor and use of United States plant, and have consisted in removing snags and other obstructions between the mouth of the creek and Snow Hill.

There have been removed from the channel 162 large snags, 78 logs, 95 stumps, 48 trees, and 29 cords small snags, and from the banks 10 stumps hauled back, 16 trees trimmed, and 13½ cords brush cut. A survey was made from Grifton to the mouth of the creek.

This creek is in the second collection district of North Carolina.

Money statement.

July 1, 1897, balance unexpended	$2,130.50
June 30, 1898, amount expended during fiscal year	955.57
July 1, 1898, balance unexpended	1,174.93
July 1, 1898, outstanding liabilities	336.90
July 1, 1898, balance available	838.03
Amount (estimated) required for completion of existing project	*8,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	7,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	$10,000	$10,000	August 11, 1888	$5,000	$45,000
August 2, 1882	10,000	20,000	September 19, 1890	7,000	52,000
July 5, 1884	5,000	25,000	July 13, 1892	7,000	59,000
August 5, 1886	15,000	40,000	August 18, 1894	10,000	69,000

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	125	Fertilizers	800
Hay	100	General merchandise	125
Timber	1,600		
Shingles	50	Total	2,800

Number of passengers, 200.

Loss since last year, 14,004¾ tons, including timber. Extreme low water curtailed this item largely. Transportation lines established, none.

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* $2,000 annually for cost of maintenance and snagging not included.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890	125,225	1894	19,953
1891	55,325	1895	53,018
1892	17,491	1896	16,804¾
1893	21,173		

Statement of vessels navigating Contentnia Creek, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.
Steamers	6	153.42

M 5.

IMPROVEMENT OF TRENT RIVER, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1106.

The river has been cleared of such snags as washed in during the year, as follows: From the channel, 40 large snags, 27 logs, 4 stumps, 12 trees, and one-fourth cord small snags; from the banks, 18 trees hauled back and 3 stumps pulled and hauled back. In the next mile below Trenton the dredged cuts have filled in places, reducing the available depth to about 18 inches at low water.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1897, balance unexpended	$2,074.77
June 30, 1898, amount expended during fiscal year	787.34
July 1, 1898, balance unexpended	1,287.43
July 1, 1898, outstanding liabilities	4.80
July 1, 1898, balance available	1,282.63
Amount that can be profitably expended in fiscal year ending June 30, 1900, for maintenance Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	5,000.00

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1879	$7,000	$7,000	August 11, 1888	$5,000	$50,500
June 14, 1880	10,000	17,000	September 19, 1890	5,000	55,500
March 3, 1881	5,000	22,000	July 13, 1892	5,000	60,500
August 2, 1882	10,000	32,000	August 18, 1894	4,000	64,500
July 5, 1884	10,000	42,000	June 3, 1896	2,000	66,500
August 5, 1886	3,500	45,500			

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Foreign and coastwise:		Internal:	
Cotton	5,439	Cotton	1,355
Cotton seed	124	Cotton seed	470
Cotton-seed meal	16	Cotton-seed meal	32
Tobacco	1	Rice	2
Rice	80	Grains	53
Grains	8,856	Hay	160
Hay	2,130	Potatoes	35
Potatoes	1,925½	Vegetables	17¼
Vegetables	1,019	Cattle	7
Cattle	30	Hogs	1½
Horses	120	Poultry	10
Hogs	5	Eggs	14
Poultry	16	Oysters	4
Eggs	133	Turpentine:	
Fish	1,780	Crude	....
Oysters	1,693	Spirits	3½
Clams	1,500	Wood	3,092
Rosin	1,890	Timber	26,000
Turpentine:		Lumber	575
Crude	126	Shingles	165
Spirits	350	Fertilizers	1,265
Wood	8,600	Machinery	15
Timber	6,500	General merchandise	1,500
Lumber	36,517	Horses	2
Shingles	3,485	Rosin	126
Fertilizers	800	Tobacco	32
Machinery	100		
Coal and minerals	1,000		34,936¼
General merchandise	23,365	SUMMARY.	
Tar	252		
		Foreign and coastwise	107,852½
	107,852½	Internal	34,936¼
		Total	142,788¾

Number of passengers, 11,192.

Increase since last year in internal commerce, 14,812 tons. Decrease over last year in foreign and coastwise commerce, 14,124 tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1878	22,000	1893	34,649
1890	89,985	1894	28,055
1891	45,080	1895	142,422½
1892	59,576	1896	142,100¾

Statement of vessels navigating Trent River, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	29	1,647.39	2 to 7½
Barges	10	2,500.00	5 to 7½
Schooners, sloops, etc	126	5,785.11	2 to 7½

M 6.

IMPROVEMENT OF NEUSE RIVER, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1109.

During the year the river has been thoroughly snagged from Bectons Old Field (35-mile post) to Newbern.

There have been removed from the channel 166 snags, 12 stumps, 20 logs, and 11 trees; from the banks, 1 log rolled back.

The jetties at Maple Cypress and Wing Dam Crossing were completed. Two were built at Lower Bectons Old Field, and several between 27-mile post and 30-mile post were repaired.

This river is in the collection district of Pamlico, N. C.

Money statement.

July 1, 1897, balance unexpended	$2,280.35
June 30, 1898, amount expended during fiscal year	1,367.23
July 1, 1898, balance unexpended	913.12
July 1, 1898, outstanding liabilities	2.40
July 1, 1898, balance available	910.72
Amount (estimated) required for completion of existing project	*77,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
June 18, 1878	$40,000	$40,000	August 5, 1886	$22,500	$232,500
March 3, 1879	45,000	85,000	August 11, 1888	15,000	247,500
June 14, 1880	45,000	130,000	September 30, 1890	20,000	267,500
March 3, 1881	30,000	160,000	July 13, 1892	15,000	282,500
August 2, 1882	30,000	190,000	August 18, 1894	7,000	289,500
July 5, 1884	20,000	210,000	June 3, 1896	7,000	296,500

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	6,872	Clams	1,500
Cotton seed	3,575	Rosin	1,553
Cotton-seed meal	35	Turpentine, crude	126
Tobacco, leaf	24	Turpentine, spirits	350
Rice	639	Wood	10,273
Grains	10,402½	Timber	104,712
Hay	2,416	Lumber	166,081
Potatoes	3,827½	Shingles	16,090
Vegetables	1,963	Fertilizers	12,659
Cattle	117½	Machinery	115
Horses	124	General merchandise	26,795
Hogs	13	Coal and minerals	3,050
Poultry	18¾	Tar	252
Eggs	145		
Fish	1,805	Total	380,749¼
Oysters	5,216		

Number of passengers, 12,450.

Gain over last year, 83,657 tons. Transportation lines established during the year, none.

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*$5,000 annually for cost of maintenance not included.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1877	75,000	1893	*a* 50,573
1890	328,462	1894	*a* 45,258
1891	267,650	1895	278,025½
1892	253,704	1896	297,092¼

a The statistics for 1893 and 1894 relate entirely to freight carried in bottoms on the river above Newbern. For the preceding years it covered all freight, both above and below Newbern, including rafts.

Statement of vessels navigating Neuse River, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	29	1,647.39	2 to 7.5
Barges	16	3,479.86	6 to 7.5
Schooners, sloops, etc	144	6,644.41	2 to 7.5

M 7.

IMPROVEMENT OF INLAND WATERWAY BETWEEN NEWBERN AND BEAUFORT, NORTH CAROLINA, VIA CLUBFOOT, HARLOWE, AND NEWPORT RIVERS.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1113.

Clubfoot and Harlowe creeks were cleared of the snags which had accumulated in last two years.

There were removed from the channel 11 snags and 32 logs.

This waterway is in the collection district of Pamlico and Beaufort, N. C.

Money statement.

July 1, 1897, balance unexpended	$7,085.61
June 30, 1898, amount expended during fiscal year	300.00
July 1, 1898, balance unexpended	6,785.61
Amount (estimated) required for completion of existing project	57,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	(*)

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriated.

Date.	Amount.	Aggregate.
August 2, 1882	$10,000	$10,000
August 5, 1886	10,000	20,000
August 11, 1888	15,000	35,000

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* Present available balance adequate for maintenance.

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	225	Clams	150
Cotton seed	110	Rosin	100
Rice	225	Turpentine, crude	750
Grains	700	Turpentine, spirits	250
Hay	525	Wood	8,000
Potatoes	500	Timber	11,250
Vegetables	300	Lumber	12,500
Cattle	75	Shingles	240
Horses	20	Fertilizers	640
Hogs	25	Machinery	500
Poultry	12½	General merchandise	1,200
Eggs	50		
Fish	300	Total	38,897½
Oysters	250		

Gain over last year, 9,160½ tons. Transportation lines established during the year, none. Passengers, 1,500.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890	14,000	1894	Not given.
1891	17,390	1895	29,737
1892	Not given.	1896 (estimated)	29,737
1893	Not given.		

Statement of vessels navigating waterway between Newbern and Beaufort, N. C., during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Steamers	4	111.21	3.5 to 4	70
Schooners, sloops, etc	40	371.45	2 to 3.5	745

M 8.

IMPROVEMENT OF HARBOR AT BEAUFORT, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of Chief of Engineers for 1896, page 1115.

The work during the year has been by hired labor and use of United States plant, and has been confined to the maintenance of the works previously constructed. At Fort Macon Point 1,638 feet of new sand fences was built, 4,424 feet was raised, 24,414 feet filled under, and 3,620 feet was repaired. At Shackleford Point 1,403 feet of new sand fences was built, 2,441 feet raised, 18,570 feet was filled under, and 1,680 feet was repaired.

On both sides of the entrance the beaches have been held intact with some improvement.

Beaufort is a port of entry.

Money statement.

July 1, 1897, balance unexpended	$5,634.54
June 30, 1898, amount expended during fiscal year	1,494.85
July 1, 1898, balance unexpended	4,139.69
July 1, 1898, outstanding liabilities	85.80
July 1, 1898, balance available	4,053.89
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	(*)

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836	$5,000	$5,000	August 5, 1886	$15,000	$90,000
			August 11, 1888	35,000	125,000
March 3, 1880	30,000	30,000	September 19, 1890	15,000	140,000
August 2, 1882	25,000	55,000	July 13, 1892	10,000	150,000
July 5, 1884	20,000	75,000	June 3, 1896	5,000	155,000

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	137	Clams	2,200
Cotton seed	340	Rosin	100
Tobacco, leaf	20	Turpentine, crude	750
Grains	112	Turpentine, spirits	250
Hay	50	Wood	2,000
Potatoes	600	Lumber	11,200
Vegetables	151	Shingles	75
Cattle	50	Fertilizers	1,827
Horses	25	Machinery	2½
Hogs	10	Coal and minerals	500
Poultry	15	General merchandise	4,044
Eggs	5		
Fish	8.464	Total	34,930½
Oysters	2,000		

Number of passengers, 6,120.

Loss over last year, 3,876½ tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1880	25,000	1893	62,913
1890	46,675	1894	Not given.
1891	69,330	1895	30,522½
1892	55,070	1896	38,807

Statement of vessels navigating harbor at Beaufort, N. C., during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Steamers	15	4,449.41	5 to 14	200
Schooners and sloops	137	2,867.91	2.5 to 14	2,757
Scows	3	92.53	3	60

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* Present available balance adequate.

M 9.

IMPROVEMENT OF INLAND WATERWAY BETWEEN BEAUFORT HARBOR AND NEW RIVER, NORTH CAROLINA.

There has been no work done during the year and no expenditures have been made.

The waterway is in the collection district of Beaufort, N. C.

For description of this waterway and previous operations see Annual Reports, 1892, pages 1141–1143; 1893, pages 1397, 1398; 1894, pages 1034, 1035; and 1896, pages 1117–1119.

Money statement.

July 1, 1897, balance unexpended	$1,000.00
July 1, 1898, balance unexpended	1,000.00
Amount (estimated) required for completion of existing project	6,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	6,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886	$10,000	$10,000	July 13, 1892	$10,000	40,000
August 11, 1888	5,000	15,000	August 18, 1894	2,500	42,500
September 19, 1890	15,000	30,000	June 3, 1896	1,000	43,500

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	500	Oysters	75
Cotton seed	30	Clams	1,000
Cotton-seed meal	10	Rosin	1,050
Rice	11	Turpentine, crude	420
Grains	105	Turpentine, spirits	188
Hay	180	Wood	2,560
Potatoes	60	Lumber	8,400
Cattle	125	Shingles	¾
Horses	50	Fertilizers	1,700
Hogs	50	General merchandise	1,173
Poultry	4½		
Eggs	1½	Total	19,193¾
Fish	1,500		

Number of passengers, 1,000.

Increase since last year, 1,191¾ tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1886	12,250	1894	Not given.
1890	29,332	1895	21,874
1891	30,240	1896	18,022
1893	32,638		

Statement of vessels navigating waterway between Beaufort Harbor and New River, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Steamers	2	76.16	4	100
Schooners, sloops, etc	26	1,757.39	3 to 9	303
Scows	3	92.53	4	250

M 10.

IMPROVEMENT OF NEW RIVER, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of the Chief of Engineers for 1896, page 1120.

There has been no work done on this river during the year.

Official inspections were made during the year.

The river is in the collection district of Beaufort, N. C.

For description of this river and previous operations see Annual Reports, 1892, pages 1149–1150; 1893, pages 1400, 1402; 1894, pages 1037, 1039; 1895, pages 1328, 1330; and 1896, pages 1120, 1122.

The sum of $1,000 will be required annually for maintenance of this improvement.

Money statement.

July 1, 1897, balance unexpended	$3,500.00
June 30, 1898, amount expended during fiscal year	100.00
July 1, 1898, balance unexpended	3,400.00
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	(*)

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
July 4, 1836, to July 7, 1838		$50,000	August 5, 1886	$10,000	$20,000
			August 11, 1888	3,000	23,000
August 2, 1882	$5,000	5,000	September 19, 1890	5,000	28,000
July 4, 1884	5,000	10,000	July 13, 1892	5,000	33,000

COMMERCIAL STATISTICS.

Class of goods.	Tons.	Class of goods.	Tons.
Cotton	120	Clams	50
Cotton seed	10	Horses	6¼
Cotton-seed meal	2½	Hogs	2½
Grains	87½	Rosin	672
Hay	17	Turpentine, spirits	101¼
Potatoes	30	Wood	50
Vegetables	5	Fertilizers	100
Poultry	¾	General merchandise	500
Eggs	2¼		
Fish	200	Total	2,107
Oysters	150		

Number of passengers, 1,000.

Decrease since last year, 5,102 tons. Transportation lines established during the year, none.

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* Present available balance adequate for maintenance.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1882	5,000	1894	1,147½
1890	17,359	1895	26,771¾
1891	23,838	1896	7,209
1893	1,134½		

Statement of vessels navigating New River, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.	Trips during the year.
			Feet.	
Steamers	1	74.80	3	96
Schooners	3	45.47	3.6 to 4.5	18

Several small boats, whose tonnage and draft could not be obtained, ply irregularly on the river.

M II.

IMPROVEMENT OF BLACK RIVER, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects, see Annual Report Chief of Engineers for 1896, page 1125.

No snagging during the year for want of funds. Plant has been cared for.

This river has been under the immediate charge of Mr. Charles Schuster, superintendent.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1897, balance unexpended	$770.83
June 30, 1898, amount expended during fiscal year	1.50
July 1, 1898, balance unexpended	769.33
Amount that can be profitably expended in fiscal year ending June 30, 1900, for maintenance Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,000.00

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
August 5, 1886	$3,000	$3,000	August 17, 1894	2,000	15,000
July 13, 1892	10,000	13,000	June 3, 1896	1,000	16,000

Other receipts: March 14, 1897, sale to Cape Fear River $243.34.

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1897.

	Tons.		Tons.
Cotton	69	Rosin	3,576
Grains	84	Turpentine, crude	147
Hay	13	Turpentine, spirits	579
Potatoes	15	Tar	824
Cattle	87	Wood	5,000
Horses	8	Timber	14,685
Hogs	19	Lumber	150
Poultry	7	Shingles	1,563
Fish	1	General merchandise	3,960
Fruit and vegetables	3		
Fertilizers	350	Total	31,144
Eggs	4		

Number of passengers, 344.

Decrease since last year, 37,889¼ tons, which was due in part to the water being too low for the boats to run over the upper half of the river for a large portion of the year. Transportation lines established during the year, none. All of the above passed over 12 miles of Cape Fear River, North Carolina, above Wilmington, but is not included in the report for that river.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1885	48,650	1893	45,003
1890	61,311	1894	41,130½
1891	79,429	1895	63,262
1892	56,051	1896	69,033¼

Statement of vessels navigating Black River, North Carolina, during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	4	180.72	3 to 3.5
Steam tugs	4	47.75	3.5 to 4.5
Flats	*a* 38	2,750	1.5 to 4

a About.

M 12.

IMPROVEMENT OF NORTH EAST (CAPE FEAR) RIVER, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of the Chief of Engineers for 1896, page 1122.

No snagging during the year, for want of funds. Plant has been cared for.

The work has been under the local charge of Supt. Charles Schuster.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1897, balance unexpended	$568.11
June 30, 1898, amount expended during fiscal year	1.30
July 1, 1898, balance unexpended	566.81
Amount that can be profitably expended in fiscal year ending June 30, 1900, for maintenance	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriated.

September 19, 1890	$5,000.00
July 13, 1892	5,000.00
August 18, 1894	5,000.00
Other receipts: March 4, 1897, sales to Cape Fear River	243.33
Total	15,243.33

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1897.

	Tons.		Tons.
Cotton	253	Rosin	2,407
Cotton seed	250	Turpentine, crude	150
Rice	75	Turpentine, spirits	571
Grains	330	Wood	6,000
Hay	80	Timber	26,744
Potatoes	30	Lumber	100
Fruits and vegetables	6	Shingles	312
Cattle	50	Tar	844
Horses	3	Brick	6,250
Hogs	60	Fertilizers	18,255
Poultry	12	General merchandise	600
Eggs	15		
Fish	1	Total	63,398

Decrease since last year, 21,765½ tons. Transportation lines established during the year, none.

Freight transported.

Calendar year ending December 31—	Tons.	Calendar year ending December 31—	Tons.
1890	40,596	1894	41,096
1891	30,295	1895	39,721
1892	37,429	1896	85,163½
1893	40,388		

Statement of vessels navigating Cape Fear River, North Carolina (North East River), during the calendar year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	2	92.06	3 to 3.5
Steam tugs	8	120.42	2.5 to 7.5
Steam yachts	2	18.14	4 to 4.5
Flats	*a* 44	3,300	1.5 to 4

a About.

M 13.

IMPROVEMENT OF CAPE FEAR RIVER ABOVE WILMINGTON, NORTH CAROLINA.

For previous history of this improvement and detailed statements of projects see Annual Report of the Chief of Engineers for 1896, page 1128.

Work has been carried on by use of United States plant and hired labor.

From July to September (when the plant was laid up for want of funds) the river was snagged from Fayetteville to Kellys Cove, removing 726 large snags, 102 stumps, 39 logs, and 42 trees. A sunken flat was removed from the channel near the thirty-ninth milepost. The plant has been cared for.

This work has been under the immediate charge of Supt. Charles Schuster.

This river is in the collection district of Wilmington, N. C.

Money statement.

July 1, 1897, balance unexpended	$4,431.46
June 30, 1898, amount expended during fiscal year	3,032.64
July 1, 1898, balance unexpended	1,398.82
July 1, 1898, outstanding liabilities	33.31
July 1, 1898, balance available	1,365.51
Amount (estimated) required for completion of existing project	*137,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	21,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 3, 1881	$30,000.00	$30,000.00	July 13, 1892	$15,000.00	$118,250.00
August 2, 1882	30,000.00	60,000.00	August 18, 1894	14,000.00	132,250.00
July 5, 1884	5,000.00	65,000.00	June 3, 1896	5,000.00	137,250.00
August 5, 1886	11,250.00	76,250.00	Other receipts: Sales to other appropriations during 1897		414.33
August 11, 1888	12,000.00	88,250.00			
September 19, 1890	15,000.00	103,250.00			

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1897.

	Tons.		Tons.
Cotton	645	Turpentine, crude	225
Cotton seed	82	Turpentine, spirits	910
Cotton-seed oil	34	Tar	1,922
Cotton-seed meal	15	Wood	8,000
Grains	446	Timber	24,691
Rice	175	Lumber	49
Hay	314	Shingles	1,250
Potatoes	18	Fertilizer	27,605
Fruit and vegetables	14	Machinery	27
Cattle	106	General merchandise	19,673
Horses	52	Coal	457
Hogs	60	Brick	1,813
Poultry	25		
Eggs	18	Total	91,841
Rosin	3,215		

Number of passengers, 1,480.

Decrease since last year, 7,516½ tons, which was due, in part, to the water being low for a portion of the year. Transportation lines established during the year, none. All of Black River commerce passes over 12 miles of this river, but is not included in the above.

Statement of vessels navigating Cape Fear River, North Carolina, above Wilmington, during the year ending December 31, 1897.

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	6	486.60	3.0 to 4.5
Steam tugs	6	114.42	3.5 to 7.5
Steam yachts	2	18.14	4.0 to 4.5

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*$3,000 annually for cost of maintenance and snagging not included.

Freight transported.

Calendar year ending December 31—	Tons.
1880	50,000
1890	129,000
1891	88,638
1892	72,810
1893	92,757
1894	85,497
1895	103,727
1896	99,357½

M 14.

IMPROVEMENT OF CAPE FEAR RIVER, NORTH CAROLINA, AT AND BELOW WILMINGTON.

For previous history of this improvement and detailed statements of projects see Annual Report, Chief of Engineers, for 1896, page 1131.

The work of the past fiscal year has been carried on by hired labor and use of the United States plant. It has consisted of the work of the suction dredge *Cape Fear* and clam-shell dredge *Ajax*, building dump scow, making minor surveys, and repairing and watching plant.

The suction dredge *Cape Fear*, when available for work on Cape Fear River, was employed in the Bar Channel when weather permitted, and at other times at Snows Marsh and Reaves Point, the shoals nearest the mouth of the river. She removed during the year 237,775 cubic yards of sand.

The clam-shell dredge *Ajax* worked to April and two weeks during April on Lilliput, Old Brunswick Cove, and Midnight shoals; during the remainder of April she worked at Fort Caswell, and during May and June she was at Wilmington undergoing repairs, while the tugs and scows were in use at Fort Caswell. She excavated during the year 613,406 cubic yards of mud and sand, 104 stumps, and 4 logs.

Wilmington is a port of entry.

Money statement.

July 1, 1897, balance unexpended		$173,114.01
November 15, 1897, proceeds of sale, interappropriations	$775.70	
November 24, 1897	75.66	
December 21, 1897	58.20	
		909.56
		174,023.57
June 30, 1898, amount expended during fiscal year		71,934.68
July 1, 1898, balance unexpended		102,088.89
July 1, 1898, outstanding liabilities		2,289.28
July 1, 1898, balance available		99,799.61
Amount (estimated) required for completion of existing project		*1,035,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

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* $25,000 annually for cost of maintenance where project, depth, and width has been obtained, not included.

Appropriated.

Date.	Amount.	Aggregate.	Date.	Amount.	Aggregate.
March 2, 1829, to July 22, 1854		*a* $363, 228. 92	March 3, 1881	$140, 000	$1, 277, 500. 00
July 11, 1870	$100, 000	100, 000. 00	August 2, 1882	225, 000	1, 502, 500. 00
March 3, 1871	75, 000	175, 000. 00	July 5, 1884	200, 000	1, 702, 500. 00
June 10, 1872	100, 000	275, 000. 00	August 5, 1886	157, 500	1, 860, 000. 00
March 3, 1873	100, 000	375, 000. 00	August 11, 1888	245, 000	2, 105, 000. 00
June 23, 1874	150, 000	525, 000. 00	September 19, 1890	170, 000	2, 275, 000. 00
March 3, 1875	150, 000	675, 000. 00	July 13, 1892	200, 000	2, 475, 000. 00
August 14, 1876	132, 500	807, 500. 00	August 18, 1894	200, 000	2, 675, 000. 00
June 18, 1878	160, 000	967, 500. 00	June 3, 1896	195, 000	2, 870, 000. 00
March 3, 1879	100, 000	1, 067, 500. 00	Other receipts: Sales and rents to other appropriations		1, 024. 56
June 14, 1880	70, 000	1, 137, 500. 00			

a Balance of $3,728.07 turned over to surplus fund.

Abstract of proposals for 1,000 tons of coal received in response to eleven days' advertisement by posters and circular letters, and opened at 12 o'clock m., February 23, 1898, by J. C. Loder, clerk, in absence of Capt. W. E. Craighill, Corps of Engineers, at Wilmington, N. C.

No.	Name and address of bidder.	Delivered.	Southport.	Wilmington.
1	Pyke & Weeks, Southport, N. C	In bins	$2. 88	$2. 88
			2. 68	2. 68
			2. 53	2. 53
		Alongside	2. 63	2. 63
			2. 43	2. 43
			2. 28	2. 28
2	J. A. Springer & Co., Wilmington, N. C	In bins	2. 95	2. 85
		Alongside	2. 69	2. 66
3	Geo. Harriss Sons & Co., Wilmington, N. C	In bins	2. 68	2. 74
		Alongside	2. 42	2. 48
4	Davis Coal and Coke Co., Baltimore, Md	In bins	2. 66	2. 59
		Alongside	2. 40	2. 40
5	Wm. E. Worth & Co., Wilmington, N. C	Alongside	......	2. 60
			2. 50	2. 50
6	S. M. Hamilton & Co., Baltimore, Md	In bins	2. 50	2. 60
		Alongside	2. 35	2. 35

Award was made as follows: 750 tons, at $2.85 and $2.95, to bidder No. 2, J. A. Springer & Co., and 500 tons, at $2.59, to bidder No. 4, Davis Coal and Coke Company.

Abstract of proposals for frictions for the dredge Ajax received in response to fifteen days' advertising by posters and circular letters, and opened at 9 o'clock a. m. January 26, 1898, by Charles Humphreys, assistant engineer, in absence of Capt. W. E. Craighill, Corps of Engineers, at Wilmington, N. C.

No.	Name of bidder.	Address of bidder.	Friction iron gear wheel.	Friction steel gear wheel.	Steam pinch.
1	Wilmington Iron Works	Wilmington, N. C	$3, 859	$4, 243	$435
2	Theo. Smith & Bro	Jersey City, N. J	3, 830	4, 715	315

Award was made to bidder No. 2, Theo. Smith & Bro., for the iron gear wheel friction only, at $3,830.

COMMERCIAL STATISTICS FOR YEAR ENDING DECEMBER 31, 1897.

Exports, foreign and coastwise.

[Furnished by Col. J. L. Cantwell, secretary of the Wilmington Produce Exchange.]

	Tons.
Cotton	68,245
Lumber	55,277
Shingles	2,265
Rosin	25,997
Tar	5,662
Turpentine, spirits	5,871
Turpentine, crude	98
Pitch	342
Miscellaneous (estimated)	60,000
Total	223,757

Exports, internal.

[Furnished by steamboat, flat, and raft men.]

Miscellaneous	72,292
Total of exports, foreign, coastwise, and internal	296,049

Imports, foreign and coastwise.

[Furnished by importers and manufacturers.]

	Tons.
Fertilizer	57,668
Coal	15,167
Salt	3,555
Oil	6,646
Rice	1,250
Miscellaneous (naval stores, cotton, and general merchandise)	100,000
Total	184,286

Imports, internal.

[Furnished by steamboat, flat, and raft men.]

	Tons.
Cotton	967
Tar	3,590
Turpentine, spirits	2,060
Turpentine, crude	522
Rosin	9,198
Lumber and timber	66,120
Shingles	3,125
Wood	20,000
Miscellaneous	9,509
Total	115,091
Total of imports—foreign, coastwise, and internal	299,377

Summary.

	Tons.
Exports:	
Foreign and coastwise	223,757
Internal	72,292
Imports:	
Foreign and coastwise	184,286
Internal	115,091
Total	595,426

Decrease since last year, 77,782 tons.

No transportation lines were established during the year.

Foreign commerce for the calendar year 1897.

[Furnished by Mr. J. C. Dancy, collector of customs.]

Class of goods.		Quantity.	Value.	
			Exports.	Imports.
Cotton	bales	249, 374	$7, 849, 710	....
Rosin	barrels	156, 140	257, 564	....
Tar	do	8, 557	12, 332	....
Pitch	do	778	1, 103	....
Turpentine, spirits	gallons	330, 443	89, 851	....
Lumber	M feet	10, 301	126, 068	....
Shingles	M	3, 038	16, 346	....
Miscellaneous		....	4, 476	$208, 998
Total		....	8, 357, 450	208, 998

Freight transported.

Calendar year ending December 31—	Tons.
1869	220, 000
1889	325, 512
1890	346, 557
1891	344, 743
1892	341, 468
1893	392, 965
1894	437, 623
1895	618, 054
1896	673, 208

Cotton steamers loaded at the port of Wilmington, N. C., during the calendar year ending December 31, 1897.

[Furnished by Messrs. Alex. Sprunt & Son and Mr. J. H. Sloan.]

Name of steamer.	Registered tonnage.	Draft, loaded.		Bales.
		Ft.	*In.*	
Loaded by A. Sprunt & Son:				
Moorby	1, 673	14	6	8, 752
Crathorne	1, 695	16	8	8, 680
Wm. Branfoot	1, 323	15		6, 560
Hawkhurst	1, 539	17		7, 883
Naparima	1, 043	16		4, 740
Atlantic	1, 613	16	6	7, 611
Roxby	1, 964	17	6	9, 328
Sahara	2, 664	17	11	13, 700
Amarantha	1, 753	19		8, 168
Jeanara	2, 179	18	6	10, 531
Manningtry	1, 828	17	6	9, 086
Torgorm	1, 065	15	6	4, 906
Magdala	2, 297	19		11, 242
Haxby	2, 252	19		10, 550
Chatburn	1, 225	15	9	5, 868
Annandale	2, 538	19		11, 828
Skidby	2, 421	18	4	12, 140
Kirkby	1, 976	18	6	9, 700
Corinthia	837	18	6	3, 814
Ormesby	1, 828	17	6	9, 335
Oceanic	1, 863	16	6	9, 348
Trunkby	1, 668	15	6	8, 866
Magdala	2, 297	18	8	11, 856
Loaded by J. H. Sloan:				
Vera	1, 854	18		9, 112
Anaces	1, 633	17		7, 800
Kirkhill	2, 316	19		11, 407
Rockabill	1, 611	17		7, 524
Vera, second cargo	1, 854	18		9, 053
Lucerne	1, 224	19	6	5, 664
Rosneath	1, 123	15		3, 650
Total	53, 154	....		258, 722

Statement of vessels of 100 tons and over at the port of Wilmington, N. C., for the calendar year ending December 31, 1897.

[Furnished by Capt. Edgar Williams, harbor master.]

Class of vessels.	American.		Foreign.		Total.	
	Number.	Tonnage.	Number.	Tonnage.	Number.	Tonnage.
Steamers	114	102,057	38	63,895	152	165,952
Barks			37	19,524	37	19,524
Brigs	4	1,320			4	1,320
Schooners	120	34,887	13	2,387	133	37,274
Barges	10	9,856			10	9,856
Total	248	148,120	88	85,806	336	233,926

The above does not include 10 schooners which took cargoes to Southport and Fort Caswell; 16 schooners, 4 yachts, 1 steamer, 1 barge, 2 scows, and 3 tugs which came to Southport for a harbor, and 3 steamers, 3 yachts, and 1 schooner which came to Southport for coal and supplies, the total tonnage of which is 13,275.

Vessels owned by the United States Government are not included. No record is made of steamboats plying on the rivers above Wilmington or of small vessels of less than 100 tons.

Statement of vessels plying on the Cape Fear River, North Carolina, at and below Wilmington during the calendar year ending December 31, 1897.

[This statement is in addition to that furnished by Capt. Edgar Williams.]

Class of vessels.	Number.	Aggregate net tonnage.	Draft.
			Feet.
Steamers	14	5,425.43	2.5 to 16
Steam tugs	14	339.86	2.5 to 10
Steam yachts	2	18.14	4 to 4.5

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., June 30, 1898.

CAPTAIN: I have the honor to submit the following report of operations for the improvement of Cape Fear River, North Carolina, at and below Wilmington, for the fiscal year ending June 30, 1898:

To July 1, 1897, dredging had been done at the various shoals as follows. The depths refer to mean low water.

Name of shoal.	Distance below Wilmington.	Length.	Width.	Depth.	Remarks.
	Miles.	*Feet.*	*Feet.*	*Feet.*	
Wilmington	0	3,200	270	20	
Alligator Creek	1½	9,800	148	20	
Brunswick River	3	8,600	222 to 148	18 to 20	Upper 5,800 feet 222 feet wide; lower 2,800 feet 148 feet wide; 8,600 feet 74 feet wide and 20 feet deep.
Logs and Big Island	7	10,400	148	18	
Keg Island	9½	2,200	148	18	
Lilliput	11	13,100	148	18 to 20	Of lower reach 6,000 feet is 74 feet wide, 20 feet deep; 1,000 feet is 37 feet wide, 20 feet deep; balance is 18 feet deep.
Old Brunswick Cove	13½	3,800	270	18	
Midnight	16	13,000	185 to 209	18	At angle 2,400 feet is 209 feet wide.
Reaves Point	19	2,000	148 to 185	18	Upper 900 feet is 185 feet wide; lower 1,100 feet is 148 feet wide.
Snows Marsh	20	9,600	233 to 270	16 to 18	18 feet, channel 110 feet wide; balance 16 feet to 18 feet deep.

These channels had been previously dredged to 16 feet depth for the full width of 270 feet, excepting Snows Marsh Channel, where the bottom width was 233 feet, and Keg Island Shoal, where the natural depth exceeded 16 feet. Slight shoaling had taken place in the angles at Old Brunswick Cove and Midnight Shoals, but was of a slush too soft to restrict the draft of vessels. The channel at Snows Marsh was 18 feet deep, with a least width of 110 feet. At the Ocean Bar there was a straight 20-foot mean low-water channel from deep water inside to deep water outside, with a least width of 150 feet. New Inlet and Swash Defense dams were in a good and substantial condition. The dike at Snows Marsh had been built for a length of 9,964 feet, 7,743 feet of which was built of piles and brush and the remaining 2,221 feet of a single row of closely driven piles; the pile and brush portion had been several times repaired by filling in with brush, and 2,470 feet had been repaired by a single row of closely driven piles; the portion built of close piles and the part repaired with them was in good condition, but the pile and brush portion needed repairs.

The operations for the year have principally consisted of the work of the suction dredge *Cape Fear* and clam-shell dredge *Ajax*, building dump scow, making minor surveys, and repairing and watching plant. All work was done by hired labor and United States plant.

The suction dredge *Cape Fear*, when available for work on Cape Fear River, was employed on the bar channel when weather permitted and at other times at Snows Marsh and Reaves Point channels. She has been absent from the work for about six months during the year, as follows: July 10 to 31, undergoing repairs at the Norfolk Navy-Yard; August 5 to September 27, working on ocean bar at Fernandina, Fla.; February 4 to 8, at Wilmington, putting in new pumps, and from March 22 to date, working on ocean bar at Fernandina, Fla.

The amount of work done by the boat during the year and location of the same is as follows:

Removed from Ocean Bar	cubic yards	136,027
Removed from Snows Marsh Channel	do	90,554
Removed from Reaves Point	do	11,194
Total	do	237,775

The cost of the same may be summarized as follows:

Labor, operating	$5,799.42
Coal and wood	2,941.50
Oil and engine supplies	516.40
Minor repairs	6,505.12
Property—rope, etc	76.22
Subsistence supplies	490.13
Total cost of operating	16,328.79

Other expenses chargeable to the work:

Superintendence, ranges, surveys, etc	1,533.03
Superintendence, use of steamer *Easton* (part)	652.50
Use of steamer *Easton* taking supplies down (part)	124.00
Repairs to hoister and wharf at Southport	465.50
Watching and rent of yard at Wilmington	254.04
Watching wharf at Southport while boat was away	115.50
Total	3,144.57
Total cost of operating and other expenses	19,473.36

The following supplies are now on hand and are not included in the above, but $2,059.46 worth of supplies and duplicate machinery on hand July 1, 1897, is included.

300 tons of coal, at $2.95 per ton	$885

Nine hundred and seventy-two dollars and seventy cents worth of coal and wood used by the fort is included in the $2,941.50 for coal and wood in the above account.

Fernandina (Fla.) Bar improvement has paid to Cape Fear River improvement, for material and supplies taken with the boat on her first trip, the following amounts:

For coal and wood	$148.25
For oil and engine supplies	134.17
For duplicate machinery used while away	493.28
Total	775.70

Cape Fear River improvement has paid the whole expense of keeping the boat in repair during the year, with the exception of the above $493.28 paid to Cape Fear River improvement for duplicate machinery and about $12.50, which I am informed by the captain of the boat has been spent for repairs by the Fernandina office.

As soon as the boat returns and a settlement can be had with the Fernandina office and Fort Caswell an estimate of the cost per cubic yard can be made.

A second dump scow for the clam-shell dredge *Ajax* was built during the year, at a cost of $5,620. The scow is 84 feet 8 inches by 26 feet by 10 feet 3 inches; capacity, 320 cubic yards.

The clam-shell dredge *Ajax* worked to April and two weeks during April, but during the remainder of the month she worked at Fort Caswell. Since April she has been laid up undergoing repairs, while the tugs and scows were in use at Fort Caswell. A new 4-yard sand bucket and new frictions have been purchased during the year. The frictions are now being put in the dredge.

The amount of work done by the dredge and location of the same is as follows:

	Cubic yards.	Stumps.	Logs.
From Lilliput Shoal	222,480	80	4
From Old Brunswick Cove Shoal	230,974	22	....
From Midnight Shoal	159,952	2	....
Total	613,406	104	4

The cost of the same may be summarized as follows:

Operating dredge:		
Labor	$7,119.41	
Subsistence	828.35	
Coal and wood	1,967.89	
Oil and engine supplies	770.75	
Property, rope, etc	2,527.75	
Minor repairs to dredge and quarter scow	12,309.63	
Minor repairs to dump scows	1,717.30	
Total cost of operating dredge		$27,241.08
Operating steamer *Cynthia*:		
Labor	4,101.42	
Subsistence	414.53	
Coal and wood	1,406.50	
Oil and engine supplies	157.96	
Property, rope, etc	184.80	
Minor repairs	1,328.75	
Total cost of operating *Cynthia*		7,593.96
Operating steamer *Easton*:		
Part chargeable to *Ajax*, dredging		3,700.35
Total cost of operating dredge and tugs		38,535.39
Other expenses chargeable to the work:		
New dump scow	5,620.00	
Building coal bins at Wilmington	388.13	
Wharf at Wilmington, watching, rent, etc	700.00	
Superintendence, surveys, ranges, etc	2,102.74	
Superintendence, use of steamer *Easton* (part)	1,060.61	
Total		9,871.48
Total cost of operating and other expenses		48,406.87

The following supplies are on hand and are not included in the cost of work, but $3,271.92 worth of supplies on hand July 1, 1897, is included:

Coal on hand June 30, 1898	$2,609.03

There is included in the cost of operating for the year $289.57 worth of supplies belonging to Cape Fear River and used by the fort.

As soon as a settlement is had with Fort Caswell an estimate of the cost per cubic yard can be made.

The clam-shell dredge *Ajax* has been used during the year as follows:

Used by Cape Fear River	Months	9½
Used by Fort Caswell	do	½
Repairing	do	2

During the year there was spent on her for repairs:

By Cape Fear River	$12,170.03
By Fort Caswell	28.04
Total	12,198,07

The steamer *Cynthia* has been used during the year as follows:

Used by Cape Fear River	Months	8½
Used by Fort Caswell	do	2½
Repairing	do	1

During the year there was spent on her for repairs:

By Cape Fear River	$1,328.75
By Fort Caswell	63.35
Total	1,392.10

The steamer *Easton* has been used during the year as follows:

Used by Cape Fear River	Months	5½
Used by Fort Caswell	do	4½
Repairing	do	2

During the year there was spent on her for repairs:

By Cape Fear River	$2,681.61
By Fort Caswell	40.70
Total	2,722.31

The scows have been used as follows during the year:

By Cape Fear River	Months	9
By Fort Caswell	do	3

During the year there was spent on them for repairs:

By Cape Fear River	$1,856.90
By Fort Caswell	2.60
Total	1,859.50

The following expenses were incurred in connection with the main office:

Use of steamer *Easton* (part)	1,028.93
Fitting out steamer *Cynthia* for torpedoes	240.68
Total	1,269.61

Summary of expenditures.

Operating dredge *Cape Fear*, with other expenses	$19,463.36
Operating dredge *Ajax*, with other expenses	48,406.87
Expenses chargeable to main office	1,279.61
Material on hand July 1, 1898	3,494.03
Total	72,643.87
Less material on hand July 1, 1897	6,432.88
Expenditures for the year	66,210.99
Cost of work done during the year	69,149.84

If the Fernandina office and the fort pay back nothing, the cost per cubic yard, including everything excepting your office expenses, will be 8.1 + cents, excluding logs and stumps.

In making up the cost of work the expenditures of your office are not included, but the above $1,279.61 charged to main office is included.

PRESENT CONDITION OF WORK.

Soundings taken on the center line at Snows Marsh Channel show the least depth to be 18 feet at mean low water, and that that depth is for only a short distance at the lower end.

At Lilliput Shoal the 20-foot low-water channel has been increased in width as follows: Lower reach to 148 feet width, 6,100 feet of the upper reach to 111 feet width, and the remaining 4,100 feet to 74 feet width.

At Old Brunswick Cove Shoal the 20-foot low-water channel has been dug 148 feet wide for the whole length.

At Midnight Shoal the 20-foot low-water channel has been dug as follows: The upper reach has been dug to 74 feet width and the lower reach to 37 feet width.

Other dredged channels in the river are supposed to be in about the same condition as at the beginning of the year. The shore lines of Federal Point, Zeeks Island, and the long line of beaches extending from Zeeks Island to Smiths or Baldhead Island, Baldhead Point, and Oak Island remain in about the same condition as at the report of last year.

The solid-pile portion of Snows Marsh Dike is in fair condition, but needs some repairs; the pile-and-brush portion is in bad condition, about all of the brush being out and some of the piles gone. New Inlet and Swash Defense dams are in good and substantial condition.

Very respectfully, your obedient servant,

CHAS. HUMPHREYS,
Assistant Engineer.

Capt. W. E. CRAIGHILL,
Corps of Engineers.

APPENDIX N.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

REPORT OF MAJ. E. H. RUFFNER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Waccamaw River, North Carolina and South Carolina.
2. Little Pedee River, South Carolina.
3. Great Pedee River, South Carolina.
4. Winyah Bay, South Carolina.
5. Santee River, South Carolina.
6. Wateree River, South Carolina.
7. Congaree River, South Carolina.
8. Harbor at Charleston, South Carolina.
9. Wappoo Cut, South Carolina.
10. Beaufort River, South Carolina.

UNITED STATES ENGINEER OFFICE,
Charleston, S. C., August 11, 1898.

GENERAL: There are inclosed herewith my annual reports for the fiscal year ending June 30, 1898, for works of improvement of rivers and harbors which have been in my charge.

Very respectfully,

E. H. RUFFNER,
Major of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

N 1.

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 848, Annual Report for 1880; for map of river see page 1200, Annual Report for 1889.

WORK OF PAST YEAR.

A steam snag boat was run over the river at intervals, keeping the important part of the stream in good condition. From the banks 1,080 trees and 33 cords of brush were cut; from the channel 270 logs, 208 stumps, 430 large snags, and 10 cords of small snags were removed. Of the total amount expended 4½ tenths were used on the channel and 5½ tenths on the banks. The removal of each obstruction cost approximately 40 cents.

The river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1897, none.

Money statement.

July 1, 1897, balance unexpended	$2, 864. 13
June 30, 1898, amount expended during fiscal year	2, 281. 82
July 1, 1898, balance unexpended	582. 31
Amount (estimated) required for completion of existing project	38, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	3, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved June 14, 1880	$15, 000
Approved March 3, 1881	10, 000
Passed August 2, 1882	4, 400
Approved July 5, 1884	6, 000
Approved August 5, 1886	15, 000
Of August 11, 1888	15, 000

By act of Congress—	
Approved September 19, 1890	$12, 500
Approved July 13, 1892	10, 000
Of August 18, 1894	6, 000
Of June 3, 1896	6, 000
Total	99, 900

Total expenditures, including June 30, 1898, were $72,534.33.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin ... barrels	76, 000	13, 300	$228, 000	78, 000	15, 600	$156, 000
Tar ... do	557	56	1, 114	407	81	814
Spirits of turpentine ... do	12, 000	2, 250	240, 000	14, 000	2, 809	220, 000
Turpentine, crude ... do	6, 000	840	15, 000	4, 000	600	8, 000
Cotton ... bales	5, 500	1, 375	275, 000	5, 000	1, 250	175, 000
Timber ... sticks	9, 547	14, 326	40, 980	10, 640	19, 152	53, 200
Lumber ... feet	8, 800, 000	18, 333	132, 000	9, 000, 000	15, 000	117, 000
Shingles	9, 800, 000	4, 900	78, 400	9, 200, 000	4, 600	73, 600
Rough rice ... bushels	122, 000	2, 684	152, 500	155, 100	2, 806	178, 365
Rice, clean ... barrels	12, 000	1, 950	195, 000	15, 508	2, 714	271, 390
Miscellaneous articles, tallow, eggs, wax, game, poultry, etc	....	1, 231	123, 118	....	1, 500	75, 000
Total	....	61, 245	1, 481, 112	....	66, 103	1, 328, 369
INWARD FREIGHTS.						
General merchandise	....	15, 000	750, 000	....	17, 000	850, 000
Grand total	....	76, 245	2, 231, 112	....	83, 103	2, 178, 369

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin ... barrels	53, 167	10, 633	$106, 334	72, 220	14, 444	$144, 440
Spirits of turpentine ... do	10, 893	2, 179	163, 395	14, 744	2, 948	258, 020
Crude turpentine ... do	1, 330	266	2, 660	4, 740	948	9, 480
Tar ... do	1, 238	248	2, 476	2, 388	477	4, 776
Cotton ... bales	17, 230	4, 307	603, 050	5, 668	1, 417	198, 380
Rough rice ... bushels	195, 279	4, 491	195, 279	93, 000	2, 139	106, 950
Rice, clean ... barrels	19, 945	3, 490	299, 175	6, 600	1, 155	115, 500
Rice flour ... bushels	25, 000	250	7, 500	25, 000	250	7, 500
Hides ... bales	3	1	200	6	2	400
Wool ... do	5	1	400	34	13	5, 100
Clams ... barrels	2, 121	424	8, 484	3, 091	618	12, 364
Fish ... do	363	19	95	430	21	2, 150
Lumber ... feet B. M	6, 700, 000	11, 167	100, 500	9, 158, 067	15, 263	137, 371
Timber ... pieces	10, 000	20, 000	50, 000	37, 463	37, 463	168, 583
Shingles	7, 000, 000	3, 500	56, 000	9, 244, 291	4, 622	73, 950
Total	....	60, 976	1, 595, 548	....	81, 780	1, 244, 964
INWARD FREIGHTS.						
General merchandise	....	10, 000	500, 000	....	17, 518	875, 900
Grand total	....	70, 976	2, 095, 548	....	99, 298	2, 120, 864

Commercial statistics—Continued.

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin.....barrels..	75, 000	13, 125	$93, 750	74, 000	14, 800	$185, 000
Spirits of turpentine.....do....	15, 000	2, 812	195, 000	13, 000	3, 250	195, 000
Crude turpentine.....do....	5, 130	718	8, 978	3, 500	700	8, 750
Tar.....do....	1, 000	200	2, 000	2, 500	875	10, 000
Cotton.....bales..	9, 091	2, 273	272, 730	8. 000	2, 000	320, 000
Rough rice.....bushels..	131, 000	2, 882	98, 250	147, 000	3, 234	147, 000
Rice, clean.....barrels..	15, 060	2, 447	165, 660	17, 400	2, 827	278, 400
Rice flour.....bushels..	11, 255	100	3, 000	1, 250	13	175
Hides.....bales..	4	1	200	25	6	1, 250
Wool.....do....	60	25	10, 000	95	43	2. 850
Clams.....barrels..	3, 091	618	12, 364	9, 000	1. 800	27, 000
Fish and caviare.....packages..	4, 950	200	115, 000	5, 000	124	150, 000
Lumber.....feet B. M..	9, 000, 000	15, 000	150, 000	10, 000, 000	16, 666	150, 000
Timber.....pieces..	63, 940	69, 055	224, 430	65, 000	130, 000	260, 000
Cross-ties.....	1, 338	10	335	.....	.....	.....
Shingles.....	14, 000, 000	7, 000	112, 000	13, 000, 000	6, 500	65, 000
Total.....	.....	116, 466	1, 463, 697	.....	182, 838	1, 800, 425
INWARD FREIGHTS.						
General merchandise.....	.....	12, 000	600, 000	.....	20, 550	513, 750
Grand total.....	.....	128, 466	2, 063, 697	.....	203, 388	2, 314, 175

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin.....barrels..	78, 000	13, 600	$175, 500	52, 000	10, 400	$104, 000
Spirits of turpentine.....do....	17, 500	4, 375	262, 500	15, 000	3, 750	225, 000
Crude turpentine.....do....	3, 000	600	6, 750	3, 000	600	7, 500
Cotton.....bales..	8, 000	2, 000	240, 000	10, 000	2, 500	300, 000
Tar.....barrels..	3, 150	1, 102	9, 450	2, 000	700	6, 000
Rough rice.....bushels..	150, 000	3, 300	150, 000	217, 000	4, 774	271, 250
Rice, clean.....barrels..	15, 000	3, 000	240, 000	21, 170	3, 440	412, 815
Rice flour.....bushels..	1, 250	13	190	1, 700	17	340
Hides.....bales..	50	18	2, 450	50	18	2, 450
Wool.....do....	120	48	16, 800	120	48	20, 175
Fish and vegetables.....cases..	10, 500	420	15, 750	10, 500	420	13, 750
Clams and oysters.....barrels..	9, 000	1, 800	27, 000	1, 000	200	3, 000
Game, etc.....packages..	5, 000	124	100, 000	5, 000	124	100, 000
Timber.....pieces..	75, 000	150, 000	300, 000	85, 000	170, 000	340, 000
Lumber.....feet B. M..	10, 000, 000	25, 000	150, 000	10, 000, 000	25, 000	150, 000
Shingles.....	15, 000, 000	7, 500	75, 000	15, 000, 000	7, 500	75, 000
Wood.....cords..	2, 000	2, 000	4, 000	2, 000	2, 300	4, 000
Cross-ties.....	20, 000	1, 400	6, 000	20, 000	1, 400	6, 000
Total.....	.....	216, 300	1, 781, 390	.....	233, 191	2, 041, 280
INWARD FREIGHTS.						
Miscellaneous, fertilizers, etc.....	.....	25, 000	625, 000	.....	25, 000	625, 000
Grand total.....	.....	241, 300	2, 406, 390	.....	258, 191	2, 666, 280

N 2.

IMPROVEMENT OF LITTLE PEDEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 1111, Annual Report for 1887.
For map of river see page 1214, Annual Report for 1890.

WORK OF PAST YEAR.

No work was done on the river during the year.

A small balance remains, which will be held for the purpose of removing any serious obstructions which may appear in the river.

An annual expenditure of $2,000 will be required for the maintenance of this river after the project for improvement is completed.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in the calendar year 1897, none.

Money statement.

July 1, 1897, balance unexpended	$1,485.81
June 30, 1898, amount expended during fiscal year	1,171.85
July 1, 1898, balance unexpended	313.96
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	28,000.00

For this improvement the following appropriations have been made:

By act of Congress—	
Of August 11, 1888	$5,000
Approved September 19, 1890	5,000
Approved July 13, 1892	5,000
Of August 18, 1894	4,000
Of June 3, 1896	3,000
Total	22,000

Total expenditures, including June 30, 1898, $21,686.04.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin ... barrels	3,920	686	$5,880	5,000	1,000	$10,000
Spirits of turpentine ... do	408	77	8,160	636	127	9,540
Cotton ... bales	310	78	15,500	600	150	21,000
Ton timber ... sticks	2,200	3,300	9,240	4,240	5,088	15,264
Shingles	30,000	15	240	20,000	10	160
Total	....	4,156	39,020	....	6,375	55,964
INWARD FREIGHTS.						
General merchandise	....	458	13,740	....	740	37,000
Grand total	....	4,614	52,760	....	7,115	92,964

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin ... barrels	4,400	880	$8,800	5,300	900	$10,600
Spirits of turpentine ... do	750	150	11,250	800	175	14,000
Cotton ... bales	700	175	24,500	700	150	24,000
Ton timber ... sticks	....	....	....	6,000	6,000	18,000
Timber ... do	4,050	4,050	12,150	....	....	....
Shingles	20,000	10	160	....	....	....
Eggs ... crates	275	4	550	....	....	....
Pease ... bushels	300	9	375	....	....	....
Cross-ties	....	....	....	10,000	250	3,000
Total	....	5,278	57,785	....	7,475	69,600
INWARD FREIGHTS.						
General merchandise, fertilizers, etc	....	875	43,750	....	900	45,000
Grand total	....	6,153	101,535	....	8,375	114,600

Commercial statistics—Continued.

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin....barrels..	6,000	1,050	$7,500	5,500	1,100	$11,000
Spirits of turpentine....do....	940	176	12,220	1,200	300	18,000
Cotton....bales..	1,250	312	37,500	2,000	500	80,000
Timber....sticks..	10,000	9,000	29,250	16,000	14,400	64,000
Cross-ties....	20,000	1,400	6,000	....	....	....
Miscellaneous articles, shingles, staves, etc....	....	....	....	....	50	1,500
Total....	....	11,938	92,470	....	16,350	174,500
INWARD FREIGHTS.						
General merchandise, fertilizers, etc....	....	500	25,000	....	150	7,500
Fertilizers....	....	....	....	....	550	16,500
Grand total....	....	12,438	117,470	....	17,050	198,500

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton....bales..	10,500	210	$31,500	1,500	375	$45,000
Rosin....barrels..	3,200	640	6,400	3,500	700	7,000
Spirits of turpentine....do....	550	137	8,250	700	150	10,500
Railroad cross-ties....	50,000	3,500	15,000	....	....	....
Timber....sticks..	4,000	8,000	16,000	5,000	10,000	20,000
Miscellaneous freights, shingles, staves, etc....	....	200	10,000	....	200	10,000
Total....	....	12,687	87,150	....	11,425	92,500
INWARD FREIGHTS.						
Fertilizers....	....	350	7,000	....	350	7,000
General merchandise....	....	125	6,250	....	125	6,250
Grand total....	....	13,162	100,400	....	11,900	105,750

This shows an increase of $5,350 in value over last year's statement, but a decrease of 1,262 tons.

N 3.

IMPROVEMENT OF GREAT PEDEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 753, Annual Report for 1873. For special description see page 845, Annual Report for 1880, and page 723, Annual Report for 1879. For map of river see page 1180, Annual Report for 1889.

WORK OF PAST YEAR.

During the year snagging was done between the mouth and 160 miles above. From the banks of the river 867 trees were cut, and from the channel 1,180 logs, 571 stumps, 1,440 large snags, and 1 cord of small snags were removed. Of the total amount expended eight-tenths were used on the channel and two-tenths on the banks. The removal of each obstruction cost approximately 57 cents.

The approved project provides for a channel of not less than 3½ feet depth from Smiths Mills, which is 54 miles above the mouth, to Cheraw, a distance of 118 miles. This depth has been obtained as far as the Wilmington, Columbia and Augusta Railroad Bridge, 103 miles above the mouth, and river steamers make regular trips throughout the year to that point. Beyond the bridge there is a less depth than 3½ feet. To obtain this depth it is estimated that 200,000 cubic yards of material, consisting of sand and pebbles, will have to be removed by dredging. Steamboat navigation beyond the bridge during low-water periods is impossible, and great inconvenience and expense to parties interested has resulted.

After completion of the project there will be required $8,000 per annum for maintenance.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in calendar year 1897, none.

Money statement.

July 1, 1897, balance unexpended	$7,995.15
June 30, 1898, amount expended during fiscal year	3,890.48
July 1, 1898, balance unexpended	4,104.67
July 1, 1898, outstanding liabilities	510.00
July 1, 1898, balance available	3,594.67
Amount (estimated) required for completion of existing project	9,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	4,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

For this improvement the following appropriations have been made:

By act of Congress—		By act of Congress—	
Approved June 14, 1880	$7,000	Approved September 19, 1890	$12,500
Approved March 3, 1881	6,000	Approved July 13, 1892	10,000
Passed August 2, 1882	6,000	Of August 18, 1894	6,000
Approved July 5, 1884	8,000	Passed June 3, 1896	12,000
Approved August 5, 1886	20,000		
Of August 11, 1888	20,000	Total	107,500

Total expenditures, including June 30, 1898, $103,395.33.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	5,926	1,483	$296,300	5,780	1,445	$202,300
Clean rice ... barrels	16,342	2,656	265,558	16,560	2,898	289,750
Rough rice ... bushels	83,000	1,827	103,750	88,000	1,524	101,200
Rosin ... barrels	35,800	6,265	50,120	30,000	6,000	60,100
Spirits of turpentine ... do	4,014	652	80,280	5,436	1,087	81,540
Cypress shingles	6,705,987	3,353	53,640	6,970,000	3,485	55,760
Lumber, cypress ... feet B. M.	3,000,000	6,250	45,000	3,100,000	5,166	46,500
Cypress logs ... do	22,547	33,821	81,169	...	...	...
Wood ... cords	225	225	563	2,000	2,000	4,000
Hides, wool, staves, etc	...	250	7,500	...	352	17,600
Timber ... sticks	...	...	...	51,640	61,968	216,888
Cross-ties	...	...	...	18,000	144	5,400
Total	...	56,782	983,880	...	86,069	1,080,938
INWARD FREIGHTS.						
General merchandise	...	5,562	383,450	...	6,402	320,100
Grand total	...	62,344	1,367,330	...	92,471	1,401,038

Commercial statistics—Continued.

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin........barrels..	21, 345	4, 269	$42, 690	24, 534	4, 906	$49, 068
Spirits of turpentine........do....	3, 391	678	50, 865	7, 211	1, 442	126, 192
Cotton........bales..	3, 610	903	126, 350	6, 110	1, 027	213, 850
Crude turpentine........barrels..	....	....	....	1, 340	268	2, 680
Ton timber........sticks..	58, 949	58, 949	176, 847	30, 000	60, 000	165, 000
Shingles........	9, 163, 000	4, 581	73, 304	6, 000, 000	3, 000	36, 000
Eggs and poultry........crates..	275	4	550	....	7	1, 000
Pease........bushels..	300	9	375	....	....	....
Rice, rough........do....	206, 343	4, 746	206, 343	52, 309	1, 203	60, 155
Lumber........feet B. M..	4, 000, 000	6, 667	60, 000	4, 000, 000	6, 667	80, 000
Wood........cords..	2, 800	2, 800	5, 600	2, 800	2, 800	5, 600
Tar........barrels..	850	170	1, 700	1, 200	240	2, 400
Cross-ties........	33, 000	2, 640	9, 900	48, 750	1, 215	14, 625
Miscellaneous articles, hides, wool, staves, etc........	....	400	20, 000	....	450	22, 500
Total........	....	86, 816	774, 524	....	83, 225	779, 070
INWARD FREIGHTS.						
General merchandise........	....	7, 845	392, 350	....	7, 800	390, 000
Grand total........	....	94, 661	1, 166, 874	....	91, 025	1, 169, 070

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin........barrels..	28, 500	4, 987	$35, 625	20, 000	4, 000	$40, 000
Spirits of turpentine........do....	6, 500	1, 219	84, 500	7, 000	1, 750	105, 000
Cotton........bales..	6, 000	1, 500	180, 000	5, 000	1, 250	200, 000
Crude turpentine........barrels..	1, 260	176	2, 205	3, 100	620	7, 750
Timber........sticks..	86, 000	77, 000	250, 250	90, 000	180, 000	360, 000
Shingles........	7, 000, 000	3, 500	56, 000	8, 000, 000	4, 000	40, 000
Rough rice........bushels..	85, 000	1, 870	63, 750	99, 000	2, 178	99, 000
Lumber........feet B. M..	5, 000, 000	8, 283	75, 000	7, 500, 000	12, 666	112, 500
Wood........cords..	3, 000	3, 000	4, 500	3, 000	3, 000	6, 000
Cross-ties........	50, 000	3, 500	15, 000	....	10, 000	40, 000
Staves........	80, 000	80	1, 600	....	....	....
Miscellaneous articles........	....	300	90, 000	....	500	15, 000
Total........	....	105, 415	858, 430	....	219, 964	1, 025, 250
INWARD FREIGHTS.						
General merchandise, fertilizers, etc........	....	700	35, 000	....	10, 000	300, 000
Grand total........	....	106, 115	893, 430	....	229, 964	1, 325, 250

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Rosin........barrels..	21, 425	4, 285	$42, 850	20, 074	4, 015	$40, 148
Spirits of turpentine........do....	5, 670	1, 442	86, 565	5, 423	1, 084	81, 345
Crude turpentine........do....	3, 800	760	7, 600	1, 800	202	3, 600
Cotton........bales..	8, 954	1, 797	268, 620	9, 570	2, 395	287, 100
Tar........barrels..	450	90	1, 350	1, 180	202	2, 950
Cross-ties........	68, 365	4, 785	20, 509	53, 276	3, 870	15, 982
Shingles........	10, 000, 000	5, 000	30, 000	8, 112, 000	4, 056	40, 560
Lumber, cypress........feet B. M..	5, 000, 000	10, 000	90, 000	6, 000, 000	12, 000	108, 000
Rough rice........bushels..	90, 000	1, 980	90, 000	98, 000	2, 156	122, 500
Timber, cypress........sticks..	30, 000	60, 000	120, 000	8, 000	16, 000	32, 000
Wood........cords..	550	550	1, 100	750	750	1, 500
Timber, ash........sticks..	4, 000	8, 000	12, 000	3, 000	6, 000	9, 000
Timber, pine........do....	2, 000	4, 000	4, 000	8, 000	8, 000	16, 000
Timber, holly........do....	....	....	....	1, 700	850	3, 400
Miscellaneous freights, pease, eggs, etc..	....	167	8, 350	....	200	10, 000
Total........	....	102, 856	782, 944	....	61, 780	774, 085
INWARD FREIGHTS.						
Fertilizers........	....	6, 036	120, 720	....	7, 340	146, 800
General merchandise........	....	5, 285	264, 250	....	6, 160	308, 000
Grand total........	....	114, 177	1, 167, 914	....	75, 280	1, 228, 885

N 4.

IMPROVEMENT OF WINYAH BAY, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For original project see page 1164, Annual Report for 1885. For report by Board of Engineers see Annual Report for 1889, page 1114. For description of previous operations see Report for 1894, page 1059; of 1895, page 1349; of 1896, page 1165.

WORK OF PAST YEAR.

The extension of the northern end of mud dike under contract with James A. Bryan was begun October 1, 1897, and was completed April 23, 1898. 40,313.35 cubic yards of mud filling and 48,776.6 square yards of sodding were used. A muck ditch 2,575 linear feet long was dug. Construction of the south jetty under contract with Mr. R. G. Ross was begun March 15, 1898, at high-water line on South Island. The jetty was built to partial dimensions, 1,993 linear feet. There were placed in the work 10,463.33 square yards of mattress (according to third design of specifications from high to low water line, and according to second design from low-water line seaward), 8,233.43 tons of ballast, and 1,899.60 tons of large stone. An apron consisting of mattressess and ballast stone was kept at least 1,000 feet in advance of the superstructure to prevent scouring at the end. A survey of Bottle Channel, at the entrance of the harbor, just completed, shows an increase of 1 foot in depth and 125 feet in width of channel on the bar.

The seagoing steam-pump dredge being constructed for this improvement under contract with the Bucyrus Company was nearly completed at the end of the fiscal year.

Two sextant towers were constructed on South Island for surveying purposes, and a temporary boat landing erected.

The following letter and commercial statement were furnished by Mr. W. D. Morgan, mayor of Georgetown and president of the bank here, who is an enterprising citizen and one who has taken a very deep and active interest in this improvement:

MAYOR'S OFFICE,
Georgetown, S. C., June 9, 1898.

DEAR SIR: Complying with your request contained in yours May 6, I beg to hand you commercial statistics for the port of Georgetown, S. C., and Winyaw Bay, South Carolina, for the year 1897. It shows a reduced value over the two previous years, the principal items showing a falling off being in rice, lumber, shingles, and cross-ties. The present indications are that each one of these lines will show a gratifying increase during 1898. A larger area in rice has been planted and another large sawmill is being established here, and the capacity of those already here being increased, new impetus has been given to the cross-tie business. Everything, at the present moment, points to a largely increased business of the port, which the improvement of our waterways and deepening of our bar will have a direct influence in developing. Of course disastrous storms and freshets and a prolongation of the present war with Spain may alter all present calculations and seriously cripple the commerce of the port ere the year closes. Further, I remain,

Yours, truly,

W. D. MORGAN.

REID WHITFORD, Esq.,
United States Assistant Engineer, Georgetown, S. C.

This bay is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in calendar year 1897, none.

Money statement.

July 1, 1897, balance unexpended		$366, 861. 86
June 30, 1898, amount expended during fiscal year		45, 592. 01
July 1, 1898, balance unexpended		321, 269. 85
July 1, 1898, outstanding liabilities	$11, 800. 00	
July 1, 1898, amount covered by uncompleted contracts	1, 297, 599. 59	
		1, 309, 399. 59

Amount and date of all appropriations for this work are as follows:

By act of Congress—

Approved August 5, 1886	$18, 750
Of August 11, 1888	100, 000
Approved September 19, 1890	100, 000
Approved July 13, 1892	100, 000
Of August 18, 1894	110, 000
Passed June 3, 1896	20, 000
Approved June 4, 1897	350, 000
Total	798, 750

Total expenditures, including June 30, 1898, $477, 480. 15.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Georgetown, S. C., from January 1, 1888, to December 31, 1897.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	352	124, 155	2, 818	2	479	14	1	81	8	355	124, 715	2, 840
1889	365	128, 705	2, 920	2	424	10	1	149	7	368	129, 278	2, 943
1890	385	165, 785	3, 150	6	1, 346	42	1	106	6	392	167, 237	3, 198
1891	420	191, 651	4, 035	1	245	7	2	292	14	423	192, 188	4, 056
1892	453	215, 087	4, 610	1	249	7	2	439	14	456	215, 775	4, 631
1893	506	318, 156	4, 813	1	241	7	....	....	....	507	318, 397	4, 820
1894	567	337, 520	5, 240	4	897	29	3	622	21	574	339, 039	5, 290
1895	581	339, 020	5, 386	2	467	14	....	....	....	583	339, 487	5, 400
1896	563	397, 763	5, 407	....	....	....	....	....	....	563	397, 763	5, 407
1897	541	380, 176	5, 016	1	318	7	....	....	....	542	380, 494	5, 023

CLEARED.

1888	342	121, 715	2, 735	8	1, 835	55	1	81	8	351	123, 631	2, 798
1889	357	126, 965	2, 856	6	1, 494	45	1	149	7	364	128, 608	2, 908
1890	372	160, 458	3, 069	9	1, 978	63	2	355	13	383	162, 791	3, 145
1891	384	164, 562	3, 986	9	2, 719	69	1	149	7	394	167, 420	4, 062
1892	396	187, 963	4, 094	5	1, 173	33	3	537	19	404	189, 673	4, 146
1893	428	193, 763	4, 318	4	985	27	1	174	7	433	194, 922	4, 352
1894	472	207, 447	4, 626	8	2, 035	56	3	611	21	483	210, 093	4, 703
1895	491	209, 341	4, 786	3	624	21	....	....	....	494	209, 965	4, 807
1896	459	201, 561	4, 580	3	736	23	....	....	....	462	202, 297	4, 603
1897	403	176, 190	4, 067	1	156	6	....	....	....	404	176, 346	4, 073

Commerce, foreign and domestic.

Year.	Value of exports.	Value of imports.	Duties collected.
1888	$3, 125, 000	$2, 750, 000	$32. 44
1889	3, 265, 000	2, 975, 000	....
1890	3, 454, 000	3, 175, 000	60. 54
1891	3, 291, 407	6, 895, 000	11. 64
1892	3, 989, 040	7, 347, 568	14. 82
1893	4, 100, 040	7, 349, 575	7. 23
1894	4, 364, 159	7, 821, 123	45. 60
1895	4, 397, 791	7, 890, 046	236. 72
1896	4, 934, 762	7, 074, 691	....
1897	4, 000, 651	6, 200, 865	....

Total commerce.

Year.	Amount.	Year.	Amount.
1888	$5,875,000	1893	$11,449,615
1889	6,240,000	1894	12,185,282
1890	6,629,000	1895	12,287,837
1891	9,809,077	1896	12,009,453
1892	11,336,608	1897	10,201,516

A. McP. Hamby, Jr., *Collector.*

COMMERCIAL STATISTICS, WINYAH BAY AND GEORGETOWN, S. C.

	1896.			1897.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Passengers	10,000		$20,000	9,000		$18,000
Cotton ... bales	10,000	2,500	400,000	8,000	2,100	320,000
Rough rice ... bushels	210,000	4,620	210,000	300,000	6,600	300,000
Cleaned rice ... barrels	20,000	4,400	800,000	30,000	5,870	405,000
Rice flour ... bushels	15,000	150	2,250	18,000	175	2,700
Rosin, pitch, and tar ... barrels	160,000	32,800	240,000	140,000	28,000	210,000
Spirits turpentine ... do	27,000	6,750	378,000	22,000	5,500	308,000
Cross-ties	252,000	17,640	100,800	100,000	15,000	25,000
Lumber ... feet B. M.	30,500,000	50,833	457,500	20,000,000	38,124	300,000
Shingles	20,300,000	10,150	121,800	15,000,000	7,614	37,500
Clams ... barrels	4,000	1,000	10,000	1,500	375	3,750
Canned goods, pickles, etc		83	10,000		83	10,000
Poultry and eggs		1	1,000		1	1,000
Wool and hides		7	2,000		7	2,000
Miscellaneous		625	25,000		625	25,000
General merchandise, grain, machinery, and manufactured products		10,000	1,000,000		10,000	1,100,000
Total		141,559	3,278,350		120,074	3,076,950
INWARD FREIGHTS.						
General merchandise, fertilizers, machinery, rough rice, etc		29,500	2,950,000		29,300	2,750,000
Grand total		171,059	6,228,350		149,374	5,817,950

	1898.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Passengers ... fares	8,500		$17,000
Cotton ... bales	11,000	2,750	396,000
Rice, rough ... bushels	285,000	6,270	327,750
Rice, clean ... barrels	28,500	4,631	441,750
Rice flour ... bushels	34,200	342	5,130
Rosin, pitch, and tar ... barrels	135,000	27,000	202,500
Spirits turpentine ... do	20,000	5,000	280,000
Cross-ties	75,000	6,250	18,750
Lumber ... feet B. M.	15,000,000	30,000	225,000
Shingles	10,000,000	5,000	25,000
Clams ... barrels	2,000	200	5,000
Canned goods and pickles		125	15,000
Wool, hides, and furs		9	2,500
Poultry and eggs		1	1,500
Miscellaneous		625	25,000
General merchandise, grain machinery, and manufactured products		9,100	1,000,000
		97,303	2,987,880
Imports, consisting of general merchandise, fertilizers, machinery, rough rice, etc		27,700	2,600,000
Total		125,003	5,587,880

Two new lines of transportation have been established.

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Total commerce.

Year.	Amount.	Year.	Amount.
1888	$5,875,000	1893	$11,449,615
1889	6,240,000	1894	12,185,282
1890	6,629,000	1895	12,287,837
1891	9,809,077	1896	12,009,453
1892	11,336,608	1897	10,201,516

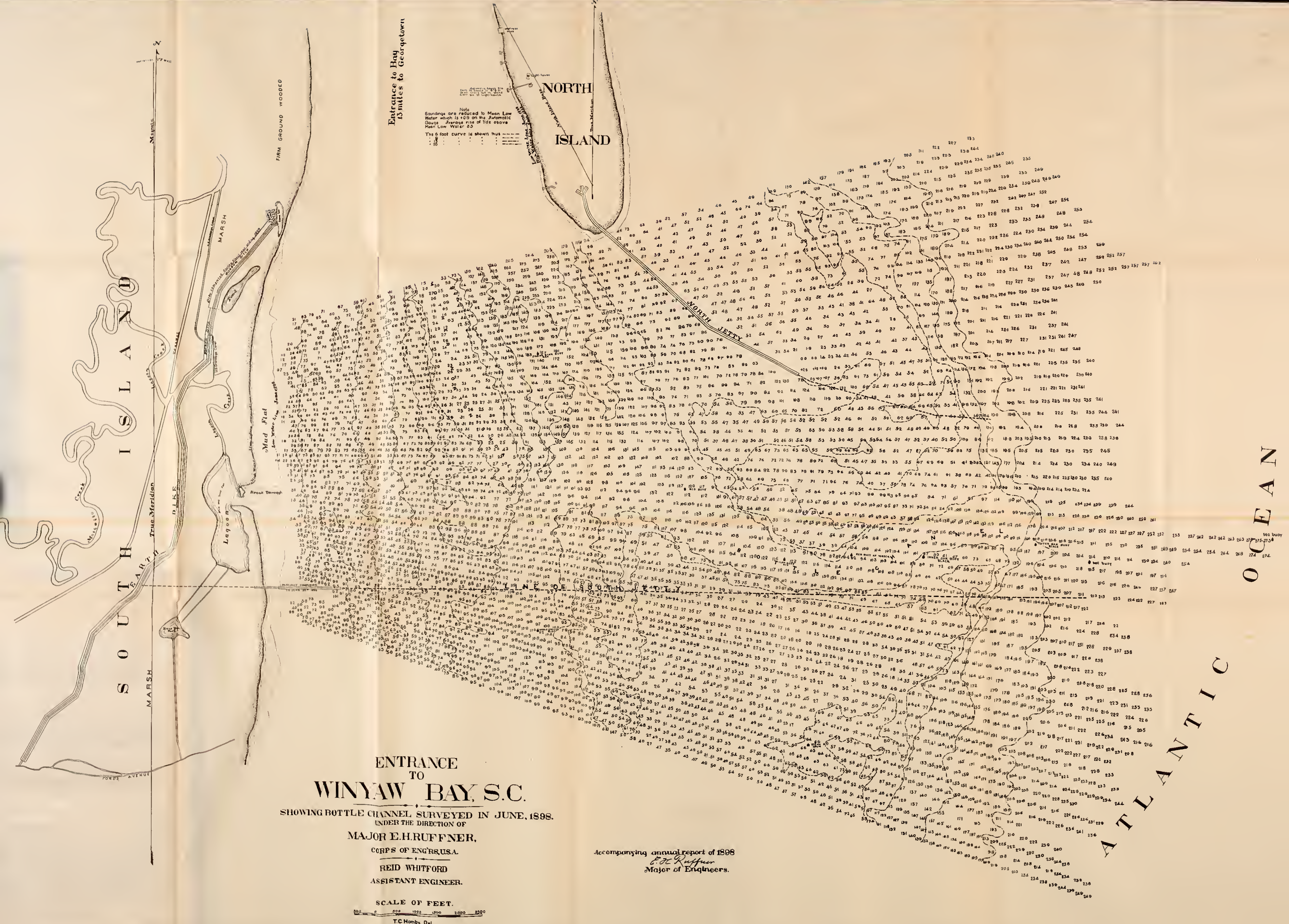
A. McP. Hamby, Jr., *Collector.*

COMMERCIAL STATISTICS, WINYAH BAY AND GEORGETOWN, S. C.

	1896.			1897.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Passengers	10,000	....	$20,000	9,000	....	$18,000
Cotton ... bales	10,000	2,500	400,000	8,000	2,100	320,000
Rough rice ... bushels	210,000	4,620	210,000	300,000	6,600	300,000
Cleaned rice ... barrels	20,000	4,400	800,000	30,000	5,870	405,000
Rice flour ... bushels	15,000	150	2,250	18,000	175	2,700
Rosin, pitch, and tar ... barrels	160,000	32,800	240,000	140,000	28,000	210,000
Spirits turpentine ... do	27,000	6,750	378,000	22,000	5,500	308,000
Cross-ties	252,000	17,640	100,800	100,000	15,000	25,000
Lumber ... feet B. M.	30,500,000	50,833	457,500	20,000,000	38,124	300,000
Shingles	20,300,000	10,150	121,800	15,000,000	7,614	37,500
Clams ... barrels	4,000	1,000	10,000	1,500	375	3,750
Canned goods, pickles, etc	....	83	10,000	....	83	10,000
Poultry and eggs	....	1	1,000	....	1	1,000
Wool and hides	....	7	2,000	....	7	2,000
Miscellaneous	....	625	25,000	....	625	25,000
General merchandise, grain, machinery, and manufactured products	....	10,000	1,000,000	....	10,000	1,100,000
Total	....	141,559	3,278,350	....	120,074	3,076,950
INWARD FREIGHTS.						
General merchandise, fertilizers, machinery, rough rice, etc	....	29,500	2,950,000	....	29,300	2,750,000
Grand total	....	171,059	6,228,350	....	149,374	5,817,950

	1898.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Passengers ... fares	8,500	....	$17,000
Cotton ... bales	11,000	2,750	396,000
Rice, rough ... bushels	285,000	6,270	327,750
Rice, clean ... barrels	28,500	4,631	441,750
Rice flour ... bushels	34,200	342	5,130
Rosin, pitch, and tar ... barrels	135,000	27,000	202,500
Spirits turpentine ... do	20,000	5,000	280,000
Cross-ties	75,000	6,250	18,750
Lumber ... feet B. M.	15,000,000	30,000	225,000
Shingles	10,000,000	5,000	25,000
Clams ... barrels	2,000	200	5,000
Canned goods and pickles	....	125	15,000
Wool, hides, and furs	....	9	2,500
Poultry and eggs	....	1	1,500
Miscellaneous	....	625	25,000
General merchandise, grain machinery, and manufactured products	....	9,100	1,000,000
		97,303	2,987,880
Imports, consisting of general merchandise, fertilizers, machinery, rough rice, etc	....	27,700	2,600,000
Total	....	125,003	5,587,880

Two new lines of transportation have been established.



ENTRANCE
TO
WINYAW BAY, S.C.

SHOWING BOTTLE CHANNEL SURVEYED IN JUNE, 1898.
UNDER THE DIRECTION OF
MAJOR E.H.RUFFNER,
CORPS OF ENG'RS.U.S.A.

REID WHITFORD
ASSISTANT ENGINEER.

T.C Hornby, Del

Accompanying annual report of 1898
E.H. Ruffner
Major of Engineers.

N 5.

IMPROVEMENT OF SANTEE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For description of river see page 916, Annual Report for 1880. For full history of work see page 1036, Annual Report for 1886. For new project and map of river see pages 1184 and 1186, Annual Report for 1889. For statement showing comparative cost of dredging by contract and by hired labor see pages 1171 and 1172, Annual Report for 1896, and page 1459, Annual Report for 1897. For miscellaneous expenses see pages 1458 and 1459, Annual Report for 1897.

WORK OF PAST YEAR.

Work on the Estherville-Minim Creek Canal, which had been cut all the way through from Winyah Bay to Minim Creek, a distance of 4.8 miles, 50 to 60 feet wide and 6 to 8 feet deep, was continued. There were removed 167,305 cubic yards of material and 648 stumps. Including all expenditures the total cost per cubic yard was 9½ cents. The accompanying map shows the location of previous work and that done during the past year. The sawmill owned by the United States was kept in operation during a part of the year; 118,598 feet, B. M., lumber was sawed.

Banks on Government land were maintained.

Two new lines of transportation have been established during the year.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is the port of entry. Amount of duties collected in calendar year 1897, none.

Money statement.

July 1, 1897, balance unexpended	$24, 987. 58
June 30, 1898, amount expended during fiscal year	16, 784. 72
July 1, 1898, balance unexpended	8, 202. 86
July 1, 1898, outstanding liabilities	1, 200. 00
July 1, 1898, balance available	7, 002. 86
Amount (estimated) required for completion of existing project	103, 450. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	20, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved March 3, 1881	$22, 000
Passed August 3, 1882	20, 000
Approved July 15, 1884	15, 000
Approved August 5, 1886	18, 750
Of August 11, 1888	24, 000
Approved September 19, 1890	30, 000
Approved July 13, 1892	$30, 000
Of August 18, 1894	40, 000
Passed June 3, 1896	48, 000
Total	247, 750

Total expenditures, including June 30, 1898, $239,547.14.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ....bales..	20, 000	5, 000	$850, 000	22, 000	5, 500	$800, 000
Rosin ....barrels..	140, 000	24, 500	175, 000	150, 000	30, 000	185, 000
Spirits of turpentine ....do....	25, 000	4, 687	350, 000	26, 000	5, 100	355, 000
Timber ....pieces..	12, 000	18, 000	60, 000	21, 000	25, 200	90, 000
Shingles	3, 000, 000	1, 500	15, 000	3, 500, 000	1, 750	17, 500
Lumber ....feet..	2, 000, 000	3, 333	20, 000	2, 000, 000	2, 000	20, 000
Railroad ties	23, 000	1, 610	6, 900	35, 000	2, 800	10, 500
Wool ....pounds..	50, 000	25	15, 000	50, 000	25	12, 500
Hides ....do....	15, 000	8	1, 500	20, 000	10	1, 600
Seed oats ....bushels..	7, 000	210	4, 200	8, 000	184	4, 800
Rice ....do....	100, 000	2, 200	150, 000	140, 000	3, 220	175, 000
Staves	500, 000	500	2, 500	400, 000	1, 000	2, 200
Wood ....cords..	10, 000	10, 000	12, 000	12, 000	12, 000	15, 000
Game and fish	....	15	1, 500	....	34	1, 700
Total	....	71, 588	1, 663, 600	....	88, 823	1, 690, 800
INWARD FREIGHTS.						
Fertilizers	....	7, 500	225, 000	....	4, 600	230, 000
Groceries, provisions, etc	....	11, 667	350, 000	....	6, 600	330, 000
Dry goods	....	4, 000	225, 000	....	4, 500	225, 000
Boots, shoes, etc	....	4, 000	200, 000	....	4, 000	200, 000
Hardware, implements, machinery ...	....	1, 500	80, 000	....	2, 000	100, 000
Grand total	....	100, 255	2, 743, 600	....	110, 523	2, 775, 800

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ....bales..	22, 000	5, 500	$700, 000	15, 000	4, 200	$575, 000
Rosin ....barrels..	161, 000	35, 000	191, 000	135, 000	27, 000	164, 000
Spirits of turpentine ....do....	26, 450	5, 200	361, 000	23, 000	4, 700	318, 000
Timber ....pieces..	23, 000	39, 400	131, 000	28, 000	32, 400	143, 000
Shingles	....	....	....	4, 000, 000	2, 000	20, 000
Lumber ....feet..	....	....	....	2, 000, 000	2, 500	25, 000
Railroad ties	46, 000	3, 500	13, 800	62, 000	4, 400	18, 600
Wool ....pounds..	50, 000	25	12, 500	50, 000	25	12, 500
Hides ....do....	20, 000	10	12, 000	25, 000	13	2, 000
Seed oats ....bushels..	10, 000	302	6, 000	11, 000	256	4, 950
Rice ....do....	....	....	....	80, 000	1, 600	48, 000
Rice, rough ....do....	125, 000	30, 000	150, 000	....	....	....
Staves	500, 000	500	2, 000	400, 000	1, 000	2, 200
Wood ....cords..	10, 000	10, 000	12, 500	15, 000	15, 000	15, 000
Game and fish	....	45	2, 300	....	34	1, 750
Total	....	102, 482	1, 594, 600	....	95, 128	1, 350, 000
INWARD FREIGHTS.						
General merchandise	....	21, 700	1, 085, 000	....	....	....
Fertilizers	....	....	....	....	4, 800	250, 000
Groceries, provisions, etc	....	....	....	....	6, 000	300, 000
Dry goods	....	....	....	....	4, 000	200, 000
Boots, shoes, etc	....	....	....	....	3, 500	175, 000
Hardware, implements, etc	....	....	....	....	2, 000	100, 000
Grand total	....	124, 182	2, 679, 600	....	115, 428	2, 375, 000

Commercial statistics—Continued.

Articles.	1895.			1896.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton .... bales..	15,000	3,750	$450,000	1,400	3,500	$427,000
Rosin .... barrels..	140,000	24,500	160,000	140,000	28,000	172,000
Spirits of turpentine .... do....	20,000	3,750	260,000	2,500	6,250	375,000
Timber .... pieces..	24,000	36,000	120,000	24,000	48,000	96,000
Lumber .... feet, B. M..	3,000,000	3,000	30,000	2,500,000	4,166	25,000
Railroad ties	60,000	4,400	15,000	60,000	4,200	15,600
Wool .... pounds..	60,000	30	16,800	50,000	25	6,000
Hides .... do....	12,000	6	500	28,000	14	1,500
Seed oats .... bushels..	8,000	184	4,000	10,000	230	4,000
Rice, rough .... do....	160,000	3,520	120,000	100,000	2,200	95,000
Staves	400,000	1,000	4,000	400,000	400	2,000
Wood .... cords..	15,000	15,000	22,000	15,000	15,000	15,000
Game and fish	....	50	2,500	....	150	7,500
Shingles	5,000,000	2,500	20,000	2,000,000	1,000	8,000
Total	....	97,690	1,224,800	....	113,135	1,249,600
INWARD FREIGHTS.						
Fertilizers	....	20,000	1,000,000	....	5,000	200,000
Dry goods					3,500	175,000
Groceries, provisions, etc					6,000	280,000
Boots, shoes, etc					3,500	150,000
Hardware, machinery, etc					3,000	150,000
Grand total	....	117,690	2,224,800	....	134,135	2,204,600

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton .... bales..	15,000	4,000	$480,000	16,000	4,200	$495,000
Rosin .... barrels..	150,000	30,000	175,000	152,000	30,000	180,000
Spirits turpentine .... do....	28,000	7,000	395,000	28,300	7,075	397,000
Timber .... pieces..	12,000	24,000	80,000	10,000	20,000	65,000
Shingles	2,000,000	1,000	8,000	2,000,000	1,000	8,000
Lumber .... feet, B. M..	2,500,000	2,500	25,000	2,500,000	2,500	25,000
Railroad ties	50,000	3,500	12,500	50,000	3,500	12,500
Wool .... pounds..	70,000	35	10,500	70,000	35	10,500
Hides .... do....	2,900	14	1,740	30,000	15	1,800
Seed oats .... bushels..	12,000	192	4,200	10,000	230	4,000
Rice, rough .... do....	130,000	21,125	130,000	150,000	3,300	160,000
Staves	300,000	600	22,000	300,000	600	22,000
Wood .... cords..	15,000	17,250	15,000	15,000	17,250	15,000
Game and fish	....	90	9,000	....	100	10,000
Total	....	111,306	1,367,940	....	89,805	1,405,800
INWARD FREIGHTS.						
Fertilizers	....	7,500	210,000	....	6,500	200,000
Dry goods	....	3,700	135,000	....	3,900	147,000
Groceries, provisions, etc	....	7,000	187,000	....	7,300	191,000
Boots, shoes, etc	....	1,500	100,000	....	1,500	100,000
Hardware, machinery, etc	....	3,200	160,000	....	3,200	160,000
Grand total	....	134,206	2,159,940	....	112,205	2,203,800

Two new lines of transportation have been established.

N 6.

IMPROVEMENT OF WATEREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination, see page 914, Annual Report for 1880. For map of river see page 1190, Annual Report for 1889.

WORK OF PAST YEAR.

Snagging and clearing banks were done at points on the river where most urgently needed. From the banks, 2,069 trees and 161 cords of brush were cut; from the channel, 751 logs, 374 stumps, 289 large snags, and 13 cords of small snags were removed. Of the total amount expended, four-tenths were used on the channel and six-tenths were used on the banks. The removal of each obstruction cost, approximately, 28 cents.

To maintain this improvement there will be required $6,000 per annum.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is the port of entry. Amount of duties collected in calendar year of 1897, none.

Money statement.

July 1, 1897, balance unexpended	$2,793.41
June 30, 1898, amount expended during fiscal year	2,455.02
July 1, 1898, balance unexpended	338.39
Amount that can be profitably expended for maintenance in fiscal year ending June 30, 1900	2,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved March 3, 1881	$8,000
Passed August 2, 1882	15,000
Approved July 5, 1884	5,000
Approved August 5, 1886	7,500
Of August 11, 1888	12,000
Approved September 19, 1890	12,500

By act of Congress—	
Approved July 13, 1892	$2,500
Of August 18, 1894	2,500
Passed June 3, 1896	5,000
Total	70,000

Total expenditures, including June 30, 1898, $69,661.61.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	415	104	$20,750	617	154	$21,600
Cotton-seed oil ... barrels	270	54	3,780	395	91	4,345
Cotton-seed meal	....	27½	605	135	135	2,700
Cotton-seed hulls	....	10	25	....	15	45
Cotton seed ... bushels	1,000	15	300	....	200	2,200
Rosin ... barrels	1,000	175	1,250	3,500	700	7,000
Rice, rough ... bushels	10,000	220	12,500	7,000	161	8,750
Total	....	....	39,210	....	....	46,640
INWARD FREIGHTS.						
General merchandise	....	400	12,000	....	788	39,400
Grand total	....	1,005½	51,210	....	2,244	86,040

Commercial statistics—Continued.

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	570	143	$20,950	500	125	$15,000
Staves				5,000	10	300
Rosin ... barrels	18,000	3,600	36,000	1,400	196	1,540
Cotton-seed oil ... do	470	112	8,190	378	91	4,725
Rice, rough ... bushels	10,000	230	10,000	500	10	500
Cypress logs				8,000	16,000	40,000
Fertilizers					200	4,940
Oak staves	7,000	17	42			
Hay ... tons	12	12	216			
... bales					6	84
Cotton seed ... tons	483	483	10,626			
Linters	30	8	600	27	7	270
Cotton-seed hulls ... tons	20	20	60		25	75
Total		4,625	86,684		16,730	67,434
INWARD FREIGHTS.						
General merchandise and supplies		1,617	31,045		1,345	26,900
Grand total		6,242	117,729		18,075	94,334

Articles.	1895.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton ... bales	450	112	$13,500
Staves	10,000	10	200
Rosin ... barrels	1,100	193	1,375
Rice, rough ... bushels	1,000	22	750
Cypress timber ... sticks	10,000	20,000	50,000
Fertilizers from cotton-seed mills ... sacks	2,000	200	4,940
Other produce		40	800
Total		20,577	71,565
INWARD FREIGHTS.			
General merchandise		1,120	56,000
Grand total		21,697	127,565

Articles.	1896.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton ... bales	400	100	$16,000
Linters	400	100	1,200
Cotton-seed oil ... barrels	600	142	9,000
Cotton seed		700	14,700
Hay ... bales	4,000	200	4,000
Cotton-seed meal		125	3,125
Fertilizers		1,500	37,500
Timber ... sticks	15,000	30,000	60,000
Grain ... bushels	5,000	125	2,500
Total		32,992	148,025
INWARD FREIGHTS.			
General merchandise		1,510	75,500
Fertilizers		500	10,000
Grand total		35,002	233,525

Commercial statistics—Continued.

Articles.	1897.			1898.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton .... bales	500	100	$15,000	500	125	$15,000
Cotton-seed oil .... barrels..	550	125	5,000	550	125	5,000
Cotton seed	....	800	9,600	....	800	9,600
Hay .... bales..	2,000	100	2,000	2,000	100	2,000
Cotton-seed meal	....	200	4,000	....	200	4,000
Oats .... bushels..	5,000	115	2,000	5,000	88	2,000
Rice, rough .... do....	5,000	110	5,000	5,000	110	6,250
Cotton-seed hulls	....	20	200	....	20	200
Timber .... sticks..	20,000	40,000	80,000	40,000	80,000	160,000
Total	....	41,570	122,800	....	81,568	204,050
INWARD FREIGHTS.						
Fertilizers	....	1,000	20,000	....	1,000	20,000
General merchandise	....	1,200	60,000	....	1,000	50,000
Grand total	....	43,770	202,800	....	83,568	274,050

N 7.

IMPROVEMENT OF CONGAREE RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 1140, Annual Report for 1885. For map of river see page 1194, Annual Report for 1889. For project and estimate for lock movable dam at Granby see page 1184, Annual Report for 1896.

WORK OF PAST YEAR.

A snag boat was run over the river at intervals, keeping the important parts of the stream clear of obstructions. From the banks, 573 trees and 38 cords of brush were cut; from the channel, 346 logs, 103 stumps, 173 large snags, and 8 cords of small snags were removed.

To comply with the provisions of the approved project, which contemplates a thoroughly cleared channel 4 feet deep over the navigable length of the river, some dredging will be necessary. Until the shoals on where there are less than 4 feet depth are removed, no regular line of steamers can be run on this river.

After the project is completed there will be required $6,000 per annum for maintenance.

This river is tributary to the collection district of Georgetown, S. C. Georgetown is its port of entry. Amount of duties collected in calendar year, 1897, none.

Money statement.

July 1, 1897, balance unexpended	$1,678.07
June 30, 1898, amount expended during fiscal year	1,351.59
July 1, 1898, balance unexpended	326.48
Amount (estimated) required for completion of existing project	23,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	1,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

For this improvement the following appropriations have been made:

By act of Congress—	
Approved August 5, 1886	$7,500
Of August 11, 1888	7,500
Approved September 19, 1890	5,000
Approved July 13, 1892	5,000
Of August 18, 1894	4,000
Passed June 3, 1896	2,000
Total	31,000

Total expenditures, including June 30, 1898, $30,673.52.

COMMERCIAL STATISTICS.

Articles.	1891.			1892.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	100	25	$5,000	150	38	$5,250
Spirits of turpentine ... barrels	218	41	4,360	303	30	7,575
Rosin ... do	8,200	1,435	11,480	10,975	2,743	16,450
Cotton seed ... tons	....	....	....	....	275	2,750
Total	....	1,501	20,840	....	3,086	32,025
INWARD FREIGHTS.						
General merchandise	....	900	27,000	....	600	30,000
Grand total	....	2,401	47,840	....	3,686	62,025

Articles.	1893.			1894.		
	Number.	Tons.	Value.	Number.	Tons.	Value.
OUTWARD FREIGHTS.						
Cotton ... bales	225	56	$7,875	....	....	....
Spirits of turpentine ... barrels	250	50	3,750	200	50	$3,500
Rosin ... do	6,500	1,300	13,000	1,600	224	1,760
Hay ... bales	500	75	1,500	....	....	....
Cotton seed ... tons	500	500	5,000	....	....	....
Timber ... sticks	....	....	....	3,000	6,000	18,000
Granite ... cubic yards	....	....	....	1,200	1,500	7,500
Total	....	1,981	31,125	....	7,774	30,760
INWARD FREIGHTS.						
General merchandise	....	800	40,000	....	200	10,000
Grand total	....	2,781	71,125	....	7,974	40,760

Articles.	1895.		
	Number.	Tons.	Value.
OUTWARD FREIGHTS.			
Cotton ... bales	300	75	$9,000
Cotton seed ... sacks	3,500	350	3,500
Cotton-seed meal ... do	350	18	700
Rosin ... barrels	2,000	350	2,500
Timber ... sticks	4,000	8,000	20,000
Total	....	8,793	35,700
INWARD FREIGHTS.			
General merchandise	....	200	10,000
Grand total	....	8,993	45,700

Commercial statistics—Continued.

Articles.		1896.		
		Number.	Tons.	Value.
OUTWARD FREIGHTS.				
Cotton	bales	500	125	$20,000
Rosin	barrels	2,300	460	5,750
Spirits turpentine	do	600	150	9,000
Hay	bales	11,300	565	11,300
Grain	bushels	8,500	170	4,250
Lumber	feet B. M.	120,000	200	2,400
Staves:				
Oak		135,000	337	2,700
Pine		100,000	100	500
Timber	sticks	7,000	14,000	28,000
Total		....	16,107	83,900
INWARD FREIGHTS.				
Fertilizers		....	600	15,000
General merchandise		....	1,600	80,000
Grand total		....	18,307	178,900

Articles.		1897.		
		Number.	Tons.	Value.
OUTWARD FREIGHTS.				
Cotton	bales	100	20	$3,000
Rosin	barrels	1,000	200	2,000
Spirits turpentine	do	200	40	3,000
Hay	bales	1,200	60	1,200
Grain	bushels	1,500	37	700
Staves, oak and pine		40,000	100	3,200
Timber	sticks	20,000	40,000	80,000
Total		....	40,457	93,100
INWARD FREIGHTS.				
General merchandise		....	300	15,000
Fertilizers		....	100	2,000
Grand total		....	40,857	110,100

Articles.		1898.		
		Number.	Tons.	Value.
OUTWARD FREIGHTS.				
Cotton	bales	400	100	$12,000
Cotton seed	sacks	3,500	350	3,500
Cotton-seed meal		....	25	500
Rosin	barrels	2,000	350	4,000
Spirits turpentine	do	200	50	3,000
Hay	bales	1,000	50	1,000
Grain	bushels	1,500	37	700
Timber	sticks	40,000	80,000	160,000
Total		....	80,962	184,700
INWARD FRIEGHTS.				
General merchandise		....	300	15,000
Fertilizers		....	100	2,000
Grand total		....	81,362	201,700

N 8.

IMPROVEMENT OF HARBOR AT CHARLESTON, INCLUDING SULLIVANS ISLAND AND MOUNT PLEASANT SHORE, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For history of operations to June 30, 1888, see page 970, Annual Report for 1888. For modified project, including estimates, see page 1150, Annual Report for 1889. For full history of all operations up to and including the completion of the jetties, with full discussion of the projects and costs, see page 1189, Annual Report for 1896.

WORK OF PAST YEAR.

Work under an informal agreement with Jacob Friday & Sons for raising the inner end of the North Jetty was continued until September 17, on which date it was completed. During the fiscal year 7,779 short tons of stone were deposited on the jetty from 220 to 700 feet from the shore end, and 1,569 short tons within low-water line. Prior to June 30, 1897, there had been deposited under this agreement 2,316 tons beyond low water and 330 tons at low water, making a total of 10,095 tons beyond and 1,899 within the low-water line. Most of this stone was in pieces from 1 ton to 7 tons in weight. Of the latter amount some was in smaller pieces, viz, from 50 to 500 pounds in weight. The jetty was extended inward about 200 feet and raised considerably above high water.

The dredge *Charleston* worked until October 9, at which time she was sent to Newport News, Va., for repairs, as she was leaking badly. Resuming work on November 2 she continued working until June 25, with occasional intermissions for minor repairs to her machinery. It having been found when she was at Newport News in October that she needed more extensive repairs, a contract for this work was made with the Newport News Dry Dock and Shipbuilding Company, and she left Charleston for that place on July 1, 1898. She removed and dumped during the year 183,429 cubic yards of material from the outer and 206,841 cubic yards from the inner shoal.

Only one partial survey was made during the year. This was completed in January, 1898, and a copy is submitted herewith. It shows a channel not less than 21 feet deep at low water, but rather too narrow and crooked for safe navigation. There is a good channel at least 20 feet deep at low water. The shading on the chart is made to show the channel of over 21 feet. This is not over 75 feet wide at the narrowest part. At the outer end there is a distance of about 700 feet on center line of the dredge cut where less than 21 feet depth is shown. The shoalest sounding on this line is 20.3 feet.

The seaward movement of the outer shoals is maintained, but these shoals continue to diminish in area. The area of less than 21 feet at low water between the extended lines of the jetties and beyond the ends was 153 acres in June, 1897, and 144 acres in January, 1898. The area less than 18 feet was 82 acres in 1897, and 77 acres in January, 1898. The area less than 15 feet was 48 acres in 1897, and 45 acres in 1898. The area less than 12 feet was 8 acres in 1897, and 6 acres in 1898.

There has been no examination of the jetties, but no material changes have appeared in their exposed portions.

The high-water line east of the North Jetty on Sullivans Island has advanced seaward as a result of the work done last summer, but there has been no accretion west of this jetty so far as can be detected by inspection.

This work is in the collection district of Charleston, S. C., which is the port of entry. Amount of duties collected in the calendar year 1897, $76,802.23.

Money statement.

July 1, 1897, balance unexpended		$180,636.70
June 30, 1898, amount expended during fiscal year		58,617.08
July 1, 1898, balance unexpended		122,019.62
July 1, 1898, outstanding liabilities	$815.00	
July 1, 1898, amount covered by uncompleted contracts	2,500.00	
		3,315.00
July 1, 1898, balance available		118,704.62

For this improvement the following appropriations have been made:

By act of Congress—	
Approved June 18, 1878	$200,000
Approved March 3, 1879	200,000
Approved June 14, 1880	170,000
Approved March 3, 1881	175,000
Passed August 2, 1882	300,000
Approved July 5, 1884	250,000
Approved August 5, 1886	187,500
Of August 11, 1888	350,000
By act of Congress—	
Approved Sept. 19, 1890	$370,000
Approved July 13, 1892	225,000
Approved March 3, 1893	750,000
Approved August 18, 1894	450,000
Approved March 2, 1895	500,000
Total	4,127,500

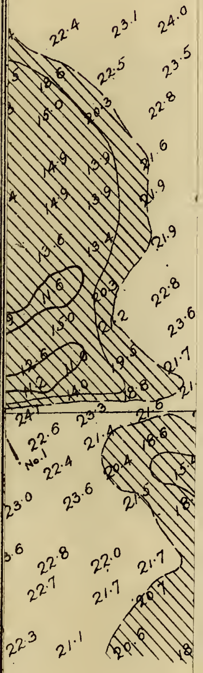
Total expenditures to June 30, 1898, $4,064,079.76.

Abstract of proposals for furnishing materials, docking, and repairing dredge "Charleston," received in response to advertisement of March 31, 1898, and opened April 30, 1898, by Major E. H. Ruffner, Corps of Engineers.

	Price.
S. J. Pregnall	Informal.
Newport News Shipbuilding and Dry Dock Co	$2,476.88
S, W. Skinner (only one copy bid, no bond)	2,281.06

Contract in force.

Contract for	Name of contractor.	Date of approval.	Date of commencement.	Date of completion.
Repairing dredge Charleston.	Newport News Shipbuilding and Dry Dock Co.	June 24, 1898	June 1, 1898	Aug. 1, 1898



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By act of Congress—	
Approved Sept. 19, 1890	$370,000
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Total	4,127,500

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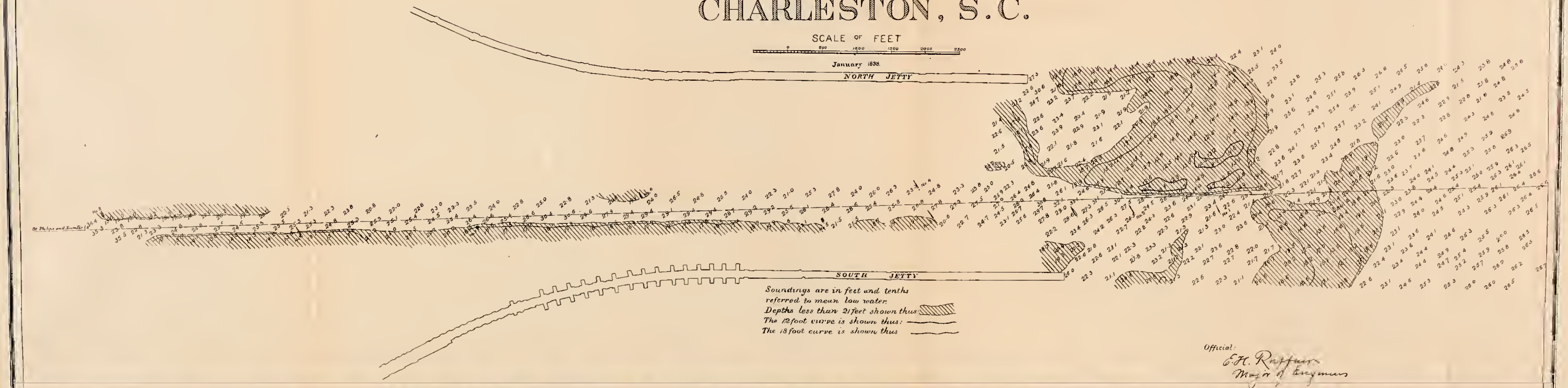
S, W. Skinner (only one copy bid, no bond)	2,281.06

Contract in force.

Contract for	Name of contractor.	Date of approval.	Date of commencement.	Date of completion.
Repairing dredge Charleston.	Newport News Shipbuilding and Dry Dock Co.	June 24, 1898	June 1, 1898	Aug. 1, 1898

LOW WATER DEPTHS
IN
JETTY CHANNEL
CHARLESTON, S.C.



Soundings are in feet and tenths referred to mean low water.
Depths less than 21 feet shown thus ▨
The 12 foot curve is shown thus: ～
The 18 foot curve is shown thus ～

Official:
E. H. Ruffner
Major of Engineers

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Charleston, S. C., from January 1, 1875, to December 31, 1897.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875	504	382, 018	11, 949	38	13, 144	326	198	88, 879	2, 404	740	484, 041	14, 379
1876	471	340, 439	10, 113	44	11, 898	335	224	101, 272	2, 768	739	453, 609	13, 216
1877	400	324. 919	9, 885	32	13, 972	308	336	105, 480	2, 851	668	444, 371	13, 044
1878	396	322, 527	9, 623	44	19, 935	455	329	163, 368	3, 967	772	505, 830	14, 045
1879	383	326, 681	10, 027	39	12, 505	319	249	121, 503	3, 292	668	460, 659	13, 638
1880	441	388, 026	20, 641	38	12, 412	327	191	110, 771	2, 595	670	511, 209	13, 563
1881	412	399, 732	10, 377	34	9, 430	272	257	121, 077	3, 073	703	530, 239	13, 722
1882	410	384, 690	9, 446	35	4, 807	224	200	105, 647	2, 648	645	495, 144	12, 318
1883	345	277, 538	7, 629	26	3, 002	157	239	113, 768	2, 958	610	394, 308	10, 744
1884	425	304, 382	9, 822	21	3, 910	145	214	134, 076	3, 269	690	442, 368	13, 236
1885	375	268, 477	9, 637	15	2, 344	97	187	106, 233	2, 586	577	377, 054	12, 320
1886	901	550, 209	....	20	3, 714	131	182	114, 507	2, 646	1, 103	668, 403	......
1887	927	656, 949	....	30	7, 074	199	127	67, 257	1, 607	1, 084	731, 280	......
1888	[a] 924	601, 771	....	34	7, 750	252	127	72, 921	1, 779	1, 085	682, 442	......
1889	[b] 339	481, 718	9, 708	30	6, 985	216	136	87, 101	1, 979	496	575, 804	11, 903
1890	[c] 410	600, 776	13, 677	35	7, 205	242	120	81, 518	1, 828	565	689, 499	15, 745
1891	[d] 417	680, 776	15, 695	27	4, 665	179	150	119, 199	2, 383	594	804, 640	18, 257
1892	[e] 388	625, 880	14, 705	28	5, 138	193	87	69, 091	1, 416	503	700, 109	16, 314
1893	[f] 338	566, 923	13, 106	28	6, 622	202	108	92, 532	1, 970	474	666, 077	15, 278
1894	[g] 327	574, 423	13, 155	22	4, 765	137	100	100, 213	1, 856	449	679, 401	15, 148
1895	[h] 369	625, 121	14, 328	21	5, 569	197	57	51, 666	999	447	682, 356	15, 524
1896	[i] 333	583, 438	14, 251	22	7, 058	170	74	75, 564	1, 390	429	666, 060	15, 811
1897	[j] 458	782, 031	19, 135	10	3, 495	125	107	133, 486	2, 267	575	919, 012	21, 527

[a] Of these, 32 vessels (tonnage, 31,035), with crews numbering 608, were foreign.
[b] Of these, 29 vessels (tonnage, 9,440), with crews numbering 546, were foreign.
[c] Of these, 58 vessels (tonnage, 55,533), with crews numbering 1,110, were foreign.
[d] Of these, 34 vessels (tonnage, 39,078), with crews numbering 717, were foreign.
[e] Of these, 31 vessels (tonnage, 30,949), with crews numbering 562, were foreign.
[f] Of these, 31 vessels (tonnage, 36,156), with crews numbering 633, were foreign.
[g] Of these, 9 vessels (tonnage, 12, 025), with crews numbering 212, were foreign.
[h] Of these, 22 vessels (tonnage, 20,936), with crews numbering 487, were foreign.
[i] Of these, 15 vessels (tonnage, 24,399), with crews numbering 386, were foreign.
[j] Of these, 4 vessels (tonnage, 6,327), with crews numbering 114, were foreign.

Arrivals and clearances of vessels and commerce at Charleston, S. C., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1875	461	328, 266	10, 830	57	24, 679	555	211	94, 595	2, 527	729	447, 540	13, 912
1876	431	278, 744	9, 095	60	23, 598	546	230	103, 276	2, 812	721	405, 618	12, 453
1877	335	234, 429	7, 719	35	22, 767	423	250	108, 446	2, 910	620	365, 662	11, 052
1878	266	172, 988	5, 801	45	24, 397	479	398	149, 975	3, 591	509	347, 360	14, 045
1879	287	188, 212	6, 268	34	11, 282	292	278	149, 052	3, 643	599	348, 546	10, 203
1880	296	190, 733	6, 348	45	23, 210	481	246	155, 768	3, 375	587	369, 711	10, 204
1881	268	187, 569	5, 942	32	9, 239	255	278	153, 796	3, 464	578	350, 604	9, 661
1882	147	113, 699	3, 690	40	7, 375	273	263	158, 250	3, 584	450	379, 324	7, 546
1883	98	48, 714	2, 018	27	4, 560	181	299	154, 653	3, 815	424	207, 927	6, 014
1884	212	116. 020	4, 555	31	7, 845	217	276	161, 588	3, 727	519	285, 453	8, 499
1885	191	99, 658	5, 047	24	5, 217	164	204	119, 602	2, 836	419	224, 467	8, 047
1886	890	543, 259	....	25	5, 469	165	201	126, 943	2, 875	1, 116	675, 671	....
1887	888	610, 646	....	28	5, 837	189	173	115, 218	2, 546	1, 089	731, 701	....
1888	*a*911	580, 468	....	30	5, 848	211	144	96, 146	2, 105	1, 085	682, 462	....
1889	*b*46	358, 596	778	25	5, 080	174	165	112, 037	2, 495	236	155, 713	3, 467
1890	*c*21	12, 863	292	41	10, 161	318	166	126, 078	2, 676	228	149, 102	3, 286
1891	*d*39	21, 197	436	32	6, 887	216	164	143, 398	2, 809	255	171, 482	3, 461
1892	*e*26	29, 752	565	28	5, 760	197	111	89, 390	1, 798	165	124, 902	2, 560
1893	*f*49	47, 756	978	29	5, 761	198	100	88, 421	1, 671	178	141, 938	2, 847
1894	*g*46	36, 760	723	22	5, 422	152	90	97, 769	1, 715	158	139, 951	2, 590
1895	*h*84	86, 420	1, 915	13	2, 283	96	72	81, 420	1, 331	169	170, 123	3, 342
1896	*i*69	90, 106	1, 882	8	1, 487	51	67	74, 216	1, 343	144	165, 809	3, 276
1897	*j*96	106, 359	1, 879	7	1, 364	49	77	88, 405	1, 538	180	196, 128	3, 466

a Of these, 7 vessels (tonnage, 4,295), with crews numbering 62, were foreign.
b Of these, 4 vessels (tonnage, 2,960), with crews numbering 47, were foreign.
c Of these, 7 vessels (tonnage, 6,186), with crews numbering 135, were foreign.
d Of these, 18 vessels (tonnage, 16,332), with crews numbering 303, were foreign.
e Of these, 13 vessels (tonnage, 15,068), with crews numbering 261, were foreign.
f Of these, 29 vessels (tonnage, 31,810), with crews numbering 554, were foreign.
g Of these, 19 vessels (tonnage, 15,795), with crews numbering 292, were foreign.
h Of these, 11 vessels (tonnage, 10,325), with crews numbering 222, were foreign.
i Of these, 18 vessels (tonnage, 22, 047), with crews numbering 363, were foreign.
j Of these, 40 vessels (tonnage, 58,108), with crews numbering 994, were foreign.

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.	Year.	Value of exports.	Value of imports.	Duties collected.
1875	$19, 655, 966	$680, 343	$80, 656. 00	1887	$15, 288, 316	$484, 063	$30, 817. 00
1876	18, 088, 152	455, 562	89, 168. 00	1888	13, 006, 578	625, 770	76, 398. 00
1877	16, 917, 492	161, 237	46, 848. 00	1889	16, 080, 255	664, 696	16, 728. 82
1878	21, 167, 575	184, 127	36, 990. 00	1890	15, 204, 771	836, 626	18, 356. 81
1879	18, 693, 126	127, 981	24, 070. 00	1891	21, 906, 076	1, 204, 588	24, 308. 47
1880	24. 939, 259	248, 158	46, 453. 98	1892	11, 460, 681	368, 926	15, 494. 24
1881	21, 927, 269	723, 049	99, 066. 23	1893	11, 056, 287	883, 842	16, 689. 75
1882	19, 907, 099	459, 970	45, 263. 33	1894	10, 877, 048	683, 324	28, 423. 01
1883	20, 144, 365	467, 648	48, 760. 69	1895	10, 063, 605	522, 721	31, 370. 26
1884	20, 833, 424	503, 504	36, 624. 76	1896	11, 144, 669	641, 177	19, 997. 81
1885	15, 157, 889	588, 191	32, 741. 68	1897	10, 807, 728	1, 299, 035	76, 802. 23
1886	17, 410, 000	635, 000	24, 876. 00				

N 9.

IMPROVEMENT OF WAPPOO CUT, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For original project see page 1073, Annual Report for 1881. For modified project see page 1196, Annual Report for 1889. For map of Wappoo Cut see page 1476, Annual Report for 1891.

WORK OF PAST YEAR.

Under an informal contract with Jacob Friday & Sons, 472 short tons of riprap stone were distributed over the old work along the banks of Elliott Cut, raising and reinforcing this revetment. The work is now in good condition.

No new transportation lines have been established.

This work is in the collection district of Charleston, S. C., which is its port of entry. Amount of duties collected during the calendar year 1897, $76,802.23.

Money statement.

July 1, 1897, balance unexpended	$2,370.53
June 30, 1898, amount expended during fiscal year	1,086.00
July 1, 1898, balance unexpended	1,284.53
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	25,500.00

For this improvement the following appropriations have been made:

By act of Congress—	
Approved March 3, 1881	$10,000
Passed August 2, 1882	10,000
Approved July 5, 1884	3,000
Approved August 5, 1886	5,000
Of August 11, 1888	5,000
Approved September 19, 1890	10,000

By act of Congress—	
Approved July 13, 1892	$10,000
Of August 18, 1894	7,000
Passed June 3, 1896	2,500
Total	62,500

Total expenditures, including June 30, 1898, $61,215.47.

COMMERCIAL STATISTICS.

Articles.	1888.		1889.	
	Quantity.	Value.	Quantity.	Value.
Phosphate rock, tons	60,000	$300,000	70,000	$475,000
Sea-island cotton, bags	6,000	360,000	10,000	750,000
Rice, bushels	150,000	150,000	250,000	262,500
Vegetables, crates	120,000	240,000	80,000	125,000
Fertilizers, tons	2,000	30,000	2,500	40,000
Lumber, feet	20,000,000	160,000	22,500,000	190,000
Shingles, cross-ties, and other articles				25,000
Total		1,240,000		1,867,500

Articles.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
Phosphate rock, tons	75,000	$525,000	65,000	$300,000
Sea-island cotton, bags	12,000	800,000	10,000	850,000
Rice, bushels	240,000	250,000	400,000	300,000
Vegetables, crates	90,000	160,000	95,000	200,000
Fertilizers, tons	1,400	21,000	3,000	37,500
Lumber, feet	25,000,000	200,000	30,000,000	275,000
Shingles, cross-ties, and other articles		20,000	50,000	35,000
Total		1,976,000		1,997,500

Commercial statistics from January 1 to December 31, 1893.

Articles.	Number.	Tons.	Value.
Phosphate rock	....	78,500	$395,500
Sea-island cotton ... bags	5,000	....	450,000
Rice ... bushels	360,000	....	350,000
Vegetables ... crates	120,000	....	260,000
Fertilizers	....	4,300	70,000
Lumber ... feet	35,000,000	....	290,000
Shingles and other articles	....	60,000	50,000
Total	....	142,800	1,865,500

Commercial statistics, Wappoo Cut, South Carolina, 1895.

Articles.	Number.	Tons.	Value.
Phosphate rock	....	75,000	$325,000
Sea-island cotton ... bags	3,600	600	225,000
Rice ... bushels	425,000	18,750	425,000
Vegetables ... crates	125,000	6,000	250,000
Fertilizers	3,000	3,000	58,000
Timber, lumber, wood ... feet	40,000,000	80,000	340,000
Shingles, cross-ties, and other articles	....	55,000	60,000
Total	....	238,350	1,683,000

Summary of business from January 1 to December 31, 1895.

Articles.	Number.	Tons.	Value.
Phosphate rock	....	80,000	$300,000
Sea-island cotton ... bags	6,200	950	420,000
Rice ... barrels	70,000	10,000	800,000
Vegetables ... crates	136,000	780	265,000
Fertilizers	....	3,500	60,100
Lumber ... feet	50,000,000	95,000	350,000
Shingles and miscellaneous articles	....	60,000	65,000
Total	....	250,230	2,260,100

Commercial statistics, January 1 to December 31, 1896.

Articles.	Number.	Tons.	Value.
Phosphate rock	....	85,000	$325,000
Sea-island cotton ... bags	7,000	1,000	460,000
Rice ... barrels	68,000	9,800	780,000
Vegetables ... crates	185,000	1,200	325,000
Fertilizers	....	7,000	75,000
Lumber ... feet	55,000,000	98,000	375,000
Shingles and other miscellaneous articles	....	70,000	70,000
Total	....	272,000	2,410,000

N 10.

IMPROVEMENT OF BEAUFORT RIVER, SOUTH CAROLINA.

REFERENCE TO PAST REPORTS.

For preliminary examination see page 1235, Annual Report for 1890. For reason for increasing estimate see page 1529, Annual Report for 1893.

During the year no work was done.

This river is tributary to the collection district of Beaufort, S. C. Beaufort is the port of entry. Amount of duties collected in calendar year 1897, $2,537.37.

Money statement.

July 1, 1897, balance unexpended	$571.64
June 30, 1898, amount expended during fiscal year	3.35
July 1, 1898, balance unexpended	568.29
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	9,000.00

For this improvement the following appropriations have been made:

By act of Congress—

Approved September 19, 1890	$12,500
Approved July 13, 1892	12,500
Of August 18, 1894	5,000
Passed June 3, 1896	1,000
Total	31,000

Total expenditures to and including June 30, 1898, $30,431.71.

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels and commerce at Beaufort, S. C., from January 1, 1888, to December 31, 1895.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	103	121,207	2,630	3	1,093	26	30	21,785	422	136	144,085	3,078
1889	98	128,834	2,728	2	1,461	19	58	54,464	1,096	158	230,193	3,853
1890	43	49,173	927	7	2,987	75	52	48,656	972	102	100,816	1,974
1891	37	40,145	786	3	1,567	26	22	21,503	416	62	63,215	1,222
1892	29	34,979	607	1	896	9	37	43,526	771	67	79,401	1,387
1893	40	51,967	854	4	3,101	38	36	45,774	771	80	100,842	1,663
1894	29	39,171	681	3	2,925	32	41	72,469	1,220	73	114,565	1,993
1895	35	47,397	823	1	1,005	12	30	51,912	1,095	66	100,314	2,039
1896	18	26,978	467	2	1,716	22	33	54,780	968	53	83,474	1,457
1897	11	17,751	262	3	1,931	26	25	42,564	792	39	61,246	1,080

CLEARED.

Year.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1888	57	63,287	1,566	3	1,465	33	78	85,523	1,561	138	150,275	3,160
1889	57	73,744	1,872	.....	....	....	98	99,898	1,944	155	173,642	3,816
1890	12	6,436	127	1	101	14	88	94,285	1,828	101	100,822	1,969
1891	7	3,921	75	.....	....	....	51	56,300	932	58	60,221	1,007
1892	7	4,268	92	.....	....	....	59	72,702	1,264	66	76,970	1,356
1893	6	6,313	110	1	296	8	67	92,248	1,494	74	98,857	1,612
1894	5	6,237	118	1	296	8	60	101,629	1,714	66	108,162	1,840
1895	5	5,902	89	.....	....	....	66	100,843	1,929	71	106,745	2,018
1896	7	8,913	127	.....	....	....	44	73,656	1,282	51	82,519	1,409
1897	3	5,644	77	.....	....	....	33	54,057	972	39	59,701	1,049

Arrivals and clearances of vessels and commerce at Beaufort, S. C., etc.—Continued.

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.
1888	$850, 393. 00	$65, 645. 36	$17. 00
1889	1, 083, 085. 00	24, 266. 00	160. 00
1890	1, 040, 197. 00	41, 005. 00	....
1891	627, 851. 00	137, 942. 54	31. 50
1892	791, 554. 00	77, 751. 49	....
1893	2, 251, 685. 50	19, 278. 31	9. 00
1894	4, 939, 417. 00	59, 054. 00	182. 06
1895	4, 155, 619. 00	70, 382. 32	1, 529. 00
1896	4, 316, 259. 00	135, 482. 62	1, 490. 40
1897	2, 605, 896. 00	84, 651. 07	2, 537. 37

APPENDIX O.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA.

REPORT OF CAPT. CASSIUS E. GILLETTE, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Savannah Harbor, Georgia.
2. Savannah River, Georgia.
3. Savannah River, above Augusta, Ga.
4. Darien Harbor, Georgia.
5. Altamaha River, Georgia.
6. Oconee River, Georgia.
7. Ocmulgee River, Georgia.
8. Brunswick Harbor, Georgia.
9. Inside water route between Savannah, Georgia, and Fernandina, Florida.
10. Removing sunken vessels or craft obstructing or endangering navigation.

United States Engineer Office,
Savannah, Ga., July 26, 1898.

General: I have the honor to transmit herewith my annual report for the fiscal year ending June 30, 1898, upon the works of river and harbor improvements then in my charge.

Very respectfully,

Cassius E. Gillette,
Captain of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

O 1.

IMPROVEMENT OF SAVANNAH HARBOR, GEORGIA.

Savannah Harbor proper is formed by the navigable part of the tidal portion of Savannah River lying within and below the limits of the city of Savannah—that is, Front River and North Channel from the Central Railroad Pier down to the sea. In a wider sense of the word the term Savannah Harbor comprises both branches of the river—that is, Front River-North Channel and Back River-South Channel from Cross Tides down to the sea.

ORIGINAL CONDITION.

In 1873, before the work of improvement was inaugurated, the usual draft of vessels navigating the river at high water was 14.5 feet. The mean rise and fall of the tide was about 6.5 feet at the city of Savannah and 7 feet at the mouth of the river.

PLAN OF IMPROVEMENT.

The original plan for the improvement of Savannah Harbor is dated August 28, 1873; that was supplemented by the project of March 19, 1879, and both of those projects were replaced by the third or enlarged project of January 16, 1882, which is given in Appendix J 4, Annual Report of the Chief of Engineers for that year, where also the earlier projects are outlined.

In 1887, in obedience to an act of Congress approved August 5, 1886, a project with estimates of cost of improvement for obtaining 28 feet of water from the city of Savannah to the sea was submitted and is outlined in Appendix N 1, Annual Report of the Chief of Engineers for 1888.

On June 30, 1890, a new project was submitted providing for a mean high-water depth of 26 feet from the city to the sea. This project, which is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890, was adopted July 22, 1890. The work contemplated by it was practically completed at the end of the fiscal year of 1896, and during the next fiscal year only repair work and a small amount of dredging was carried on in accordance with it.

In compliance with instructions from the Department, dated August 20, 1894, my predecessor submitted, on December 7, 1894, a modified plan of improvement providing for a detached extension of the Oyster Bed training wall for the purpose of sheltering the anchorage in Tybee Roads as well as for protecting the ship channel over the outer part of Tybee Knoll against the destructive action of heavy storms. This project, which is printed as part of Appendix M 1, Annual Report of the Chief of Engineers for 1895, was authorized by law of June 3, 1896, and in accordance with it work has been carried out during the fiscal year just ended.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

A detailed summary of the jetty work done prior to June 30, 1890, is given in my predecessor's report for 1891 (Report of the Chief of Engineers for 1891, p. 1492, and following). A summary of obstructions removed and of dredging done during the same period will be found in his report for 1896 (Report of the Chief of Engineers for 1896, p. 1213).

A summary of the jetty work and the dredging done under the new project from July 1, 1890, to June 30, 1896, will be found in my predecessor's report for 1896 (Report of the Chief of Engineers for 1896, pp. 1218–1220), and in the same officer's report for 1897 (Report of the Chief of Engineers for 1897, pp. 1495 and 1496).

Up to July 1, 1896, the total expenditure for the work under the project of 1890 amounted to $3,460,049.99.

The total amount expended under the present project up to June 30, 1897, amounted to $33,702.17.

CONDITION OF WORK JUNE 30, 1897.

No dredging had been done in Savannah Harbor during the fiscal year since July, 1896.

The least practicable channel depth in the upper half of Marsh Island

Channel was 15 feet at mean low and 20 feet at mean high water; in the lower half of Marsh Island it was 18 and 23 feet, respectively; from the Central Railroad elevator to West Broad street, 20 and 25½ feet, respectively, and thence down to Tybee Roads 20.2 and 26 feet, respectively. The works of improvement were in good order.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

The river and harbor act approved June 3, 1896, contained an appropriation of $5,000 for continuing this improvement, with the following provisions:

> *Provided,* That contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the project of further improvement recommended by Capt. O. M. Carter in his reports of December 7, 1894, and July 1, 1895, and to complete the project for the steamboat channel between Beaufort, S. C., and Savannah, Ga., recommended by Capt. O. M. Carter in his report of December 4, 1895, and mentioned in that report as route 2; to be paid for as appropriations may from time to time be made by law, not to exceed the amount of $1,000,000, exclusive of amount herein or heretofore appropriated.

Under this provision contracts had been entered into by my predecessor with Rittenhouse R. Moore, of Mobile, Ala., for all of the dredging, and with the Atlantic Contracting Company of New York, N. Y., for all jetty work required for the improvement.

Jetty work, under contract of October 8, 1896, with the Atlantic Contracting Company, was continued from the beginning of the fiscal year until October 11, 1897, on which date the contractor suspended work.

There were put into the detached extension of the Oyster Bed training wall 46,637.79 square yards of brush mattress and 8,211.42 cubic yards of fourth-class stone; by this work the training wall was extended 1,736 feet, making its entire length 6,986 feet, with probably an average depth of 6 feet at mean low water on its crest.

Dredging under contract of October 6, 1896, with Rittenhouse R. Moore was continued throughout the fiscal year. The following quantities of material were removed at the various places:

	Cubic yards.
1. Mouth of Wrights River	197,979.0
2. Marsh Island Channel, near Central Railroad elevator	36,100.2
3. Upper end of Marsh Island Channel	72,333.8
Total	306,413.0

The channel leading from Savannah River into Wrights River was dredged to a depth of somewhat more than 7 feet at mean low water, the old route between Long Island training wall and the shore of Jones Island being reestablished. In the vicinity of the Central Railroad elevator the channel was dredged to a depth of about 21 feet at mean low water and 250 feet wide through the shoal that had formed there, and from the upper end of Marsh Island Channel down a length of about 1,200 feet was dredged to a mean low-water depth of 18 feet and a width of about 100 feet. In Wrights River and near the Central Railroad the dredged material was loaded and measured in scows. At the upper end of Marsh Island Channel, however, the material was pumped by the dredge into the space behind the Marsh Island training wall, and the measurement was made in place on the dumping ground; 73,104 cubic yards was thus deposited.

CONDITION OF WORK JUNE 30, 1898.

No regular survey has been made, but a careful examination made in the last few days shows that very extensive shoaling has taken place since the project of 1890 was completed, two years ago. The following table, in which the quantities are only approximate, gives roughly the length of shoaling, its average depth, and the probable amount of fill:

Places.	Length of shoaling.	Least depth at mean low water at shoalest place.	Mean depth of shoaling.	Distance of shoal from upper end of improvement.	Cubic yards filled.
	Feet.	*Feet.*	*Feet.*	*Miles.*	
Marsh Island Channel	6,500	*a* 12.0 *b* 18.0	3.5	0	205,000
Garden Bank	2,000	18.5	1.5	3	30,000
Wrecks Channel:					
Lower end	1,500	19.0	2.0	5	60,000
Obstructions	2,000	19.0	1.5	6½	40,000
Upper Flats:					
Upper end	2,500	19.0	3.0	9	70,000
Lower end	1,500	18.5	2.0	9¾	30,000
Lower Flats	1,000	19.0	1.5	10½	20,000
Long Island Crossing (upper end)	1,000	18.5	1.5	12½	10,000
Long Island Crossing	7,000	17.5	3.5	14	200,000
Total					665,000

a Upper. *b* Lower.

It is to be noted that with the exception of the middle portion of the Wrecks Channel and the lower end of Lower Flats the shoaling takes place at the same localities as before improvement. Whether there has been any change in the rate of deposit has not been determined.

Presumably considerable shoaling has taken place in the long stretches of river between the above points and below the lowest one, but no examination has been made of them. Taking the above total as the entire fill for two years, and estimating the cost of removal at present contract prices, 13 cents per cubic yard, the annual cost of dredging for maintenance will be $43,225.

The worst shoal found is at the lower end of the Long Island Crossing, where there is about 17½ feet at mean low water. There was a depth of 22 feet at this point when the project was completed.

The training walls have not deteriorated during the year.

COMMERCE AND NAVIGATION.

Full discussions of the commerce of Savannah were given in the reports for 1890 and 1897 (Report of the Chief of Engineers for 1890, pp. 1252 and 1253, and for 1897, p. 1497).

The regular lines of steamships established between this port and New York, Boston, Philadelphia, and Baltimore comprise a total of 13 steamers, of which 8 run to the first-named three ports and 5 to the last-named one. During the last calendar year they made 410 voyages and carried 474,085 tons of freight.

On the inland waters there are a number of small steamers plying between Savannah and adjacent ports, making annually from 500 to 600 trips and carrying about 67,000 tons of freight, valued at about $4,000,000.

The chief articles of export are cotton, lumber, and naval stores, of which the present annual shipments may be given in round numbers as follows: Of cotton, 857,000 bales; of lumber, 126,700,000 feet, and of naval stores 305,000 barrels of turpentine and 1,143,000 barrels of rosin.

The total tonnage of the port, inward and outward bound, during 1897 was 2,099,266 tons.

MISCELLANEOUS.

This work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1897, $46,697.24. The nearest light-houses are those upon the river, and Forts Oglethorpe and Pulaski are the nearest forts.

The total expenditures under the present project up to June, 1898, amounted to $367,664.58.

Money statement.

July 1, 1897, balance unexpended	$365,782.89
Amount appropriated by sundry civil act approved July 1, 1898	450,000.00
	815,782.89
June 30, 1898, amount expended during fiscal year	333,962.41
July 1, 1898, balance unexpended	481,820.48
July 1, 1898, outstanding liabilities	78,035.11
July 1, 1898, amount covered by uncompleted contracts*	619,790.52
July 1, 1898, balance available	403,785.37
Amount (estimated) required for completion of existing project	200,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

From 1826 up to the date of the 22-foot plan of improvement appropriations amounting to $667,096.64 were made for the improvement of the harbor and for the removal of wrecks, as follows:

By act of Congress of—	
March 18, 1826	$50,000.00
March 3, 1829	24,490.00
July 3, 1832	25,000.00
March 2, 1833	43.06
March 2, 1833	8,430.62
June 28, 1834	30,000.00
March 3, 1835	20,000.00
July 7, 1838	15,000.00
August 30, 1852	$40,000.00
March 3, 1855	161,000.00
June 10, 1872	50,000.00
March 3, 1873	50,000.00
February 27, 1874	193,132.96
Total	667,096.64

Under the 22-foot plan of improvement the following appropriations were made:

By act of Congress of—	
June 23, 1874	$50,000.00
March 3, 1875	70,000.00
August 14, 1876	62,000.00
June 18, 1878	70,000.00
March 1, 1879	100,000.00
June 14, 1880	65,000.00
March 3, 1881	65,000.00
August 2, 1882	200,000.00
July 5, 1884	200,000.00
August 5, 1886	$150,000.00
August 11, 1888	180,000.00
	1,212,000.00
Unexpended balance of last appropriation carried to new project	4,035.05
Total	1,207,964.95

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* This work is carried on under continuing contract.

Under the 26-foot plan of improvement the following appropriations have been made:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$4,035.05
September 19, 1890	350,000.00
July 13, 1892	318,750.00
March 3, 1893	1,000,000.00
August 18, 1894	975,000.00
March 2, 1895	856,250.00
	3,504,035.05
Amount deposited by clerk of United States circuit court for the southern district of Georgia, March 20, 1895	500.00
	3,504,535.05
Unexpended balance of last appropriation carried to new project	44,485.06
Total	3,460,049.99

Since the existing project for improving Savannah Harbor was adopted the following appropriations have been made:

By act of Congress of—	
March 2, 1895 (unexpended balance)	$44,485.06
June 3, 1896	5,000.00
June 4, 1897	350,000.00
July 1, 1898	450,000.00
Total	849,485.06

Abstract of bids opened at Savannah, Ga., September 8, 1896, by Capt. O. M. Carter, Corps of Engineers, for improving harbor at Savannah, Ga.

No.	Name and address of bidder.	Mattresses (200,000 sq. yds).		First-class stone (25,000 tons).		Second-class stone (25,000 tons).	
		Price.	Amount.	Price.	Amount.	Price.	Amount.
2	P. Sanford Ross, Jersey City, N. J	$0.90	$180,000	$4.80	$120,000	$4.80	$120,000
5	The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y. [a]	.95	190,000	3.90	97,500	3.90	97,500
7	John L. Grim, Philadelphia, Pa	.98	196,000	4.00	100,000	4.00	100,000

No.	Name and address of bidder.	Third-class stone (50,000 cubic yards).		Fourth-class stone (100,000 cubic yards).		Total for jetty work.	Dredging 1,250,000 cubic yards.	
		Price.	Amount.	Price.	Amount.		Price.	Amount.
1	Virginia Dredging Co., J. Clements Shafer, secretary and treasurer, Richmond, Va. [b]	......	......	......	......	......	$\$0.16\frac{9}{10}$	$211,500
2	P. Sanford Ross, Jersey City, N. J.	$3.55	$177,500	$2.60	$260,000	$857,500	$.17\frac{9}{10}$	223,750
3	Savannah Dredging Co., Jacob Paulsen, president, Savannah, Ga	......	......	......	......	......	$.20\frac{1}{2}$	256,250
4	American Dredging Co., S. Y. Schermerhorn, president, Philadelphia, Pa. [c]	......	......	......	......	......	.22	275,000
5	The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y. [c]	3.50	175,000	2.75	275,000	835,000	......	......
6	Rittenhouse R. Moore, Mobile, Ala. [a]	......	......	......	......	......	.13	162,500
7	John L. Grim, Philadelphia, Pa.	3.30	165,000	2.90	290,000	851,000	......	......

REMARKS.—Amount for which the Secretary of War is authorized to enter into contracts, $1,005,000.

[a] It is recommended that the bid of the Atlantic Contracting Company, of New York, John F. Gaynor, president, for jetty work (the first five items), and of Rittenhouse R. Moore, of Mobile, Ala., for dredging (item 6), be accepted, they being the lowest responsible bidders for the best and most suitable materials and service.

[b] Bond of $50,000 submitted instead of $250,000, as required.

[c] Evidence of authority to bid not filed.

List of contracts in force.

Name and address of contractor.	Character of work.	Date of approval.	Work began.	Expires.
Rittenhouse R. Moore, Mobile, Ala.	Dredging	Oct. 28, 1896	Jan. 12, 1897	On or before the expiration of one year after the total sum of money for which the Secretary of War is authorized to enter into contract under these specifications shall have been appropriated.
The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y.	Jetty	Oct. 27, 1896	Dec. 3, 1896	

COMMERCIAL STATISTICS.

Cotton statistics of the port of Savannah, Ga., for the commercial year ending August 31, 1897.

RECEIPTS FROM ALL SOURCES.

Grade.	Quantity.	Weight.	Value.
	Bales.	*Pounds.*	
Upland	762,466	374,988,403	$27,525,022
Sea-island	84,125	32,969,428	5,027,310
Total	846,591	407,957,831	32,552,332

EXPORTS FROM SAVANNAH.

Destination.	Upland.	Sea-island.
	Bales.	*Bales.*
Coastwise	359,108	61,735
Great Britain	33,235	15,028
France	13,722	1,612
Other continental ports	370,979	1,564
Mill consumption and burned	1,088	....
Reshipped to interior	4,058	....
Total	782,190	79,939

TOTAL EXPORTS.

Grade.	Foreign exports.	Coastwise exports.	Total.
	Bales.	*Bales.*	*Bales.*
Upland	417,936	359,108	777,044
Sea-island	18,204	61,735	79,939
Total	436,140	420,843	856,983

STEAMSHIP LINES.

Lines.	Savannah to—	Steamers.	Voyages.	Freight.
				Tons.
Ocean Steamship Co	New York	8	226	226,217
Do	Boston	6	51	54,195
Do	Philadelphia	2	29	23,780
Merchants & Miners' Transportation Co	Baltimore	5	104	169,893
Total	....	21	410	474,085

NOTE.—The actual number of steamships plying between Savannah and the above Northern ports in 1897 was not 21, but only 13, this discrepancy arising from the fact that most of the Ocean Steamship Company's ships run to more than one of the three ports to which the line trades.

Cotton receipts at Savannah from 1872 to 1897.

Season August 31 to September 1.	Quantity.	Season August 31 to September 1.	Quantity.
	Bales.		*Bales.*
1872–73	612,794	1885–86	803,359
1873–74	630,372	1886–87	804,412
1874–75	614,478	1887–88	892,318
1875–76	523,244	1888–89	828,168
1876–77	477,435	1889–90	956,517
1877–78	597,449	1890–91	1,139,560
1878–79	693,764	1891–92	1,027,816
1879–80	741,018	1892–93	793,808
1880–81	889,383	1893–94	971,405
1881–82	737,056	1894–95	946,272
1882–83	817,760	1885–96	784,983
1883–84	655,749	1896–97	846,591
1884–85	728,087		

Arrival and clearance of vessels and commerce at Savannah, Ga., from January 1, 1873, to December 31, 1897.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
1873	463	381,595	11,934	34	16,140	383	213	119,316	2,999	710	517,051	15,316	17.50
1874	418	354,700	10,048	66	41,030	487	284	182,517	4,232	768	578,247	15,127	17.50
1875	370	310,887	10,102	67	39,832	781	222	145,748	3,290	659	495,923	14,173	17.50
1876	355	320,015	10,348	58	40,298	987	260	160,640	3,865	673	530,496	15,200	17.75
1877	333	379,826	10,867	54	40,948	951	287	168,247	3,950	674	589,021	15,768	18.25
1878	322	385,532	10,688	61	45,208	576	326	235,787	5,814	709	666,527	18,078	18.50
1879	319	414,794	8,235	30	21,994	1,576	279	198,040	3,960	628	634,828	12,634	17.75
1880	338	446,881	9,996	14	7,724	439	244	172,224	3,533	596	626,829	13,699	18.33
1881	382	508,422	11,069	21	10,729	170	254	151,463	3,474	658	670,614	14,780	19.00
1882	391	544,488	12,605	11	4,865	237	204	115,061	2,718	606	666,374	16,429	19.00
1883	380	468,226	10,659	10	4,115	106	160	87,020	1,965	550	559,366	12,714	18.25
1884	388	482,917	13,735	14	5,632	90	287	174,676	3,984	689	663,225	17,835	19.00
1885	395	493,610	14,622	12	5,058	116	251	163,321	3,416	658	668,989	18,163	20.75
1886	393	503,073	14,534	10	5,952	125	268	177,229	3,719	671	686,254	18,438	20.00
1887	430	543,235	15,127	8	2,725	185	231	130,136	2,800	669	676,096	17,987	20.40
1888	411	539,576	14,907	8	3,560	60	229	146,075	3,288	648	689,211	18,306	20.67
1889	409	561,463	15,547	12	6,563	111	309	215,865	4,530	730	783,891	20,231	20.70
1890	483	717,561	19,178	9	2,303	69	300	193,263	4,058	792	913,217	23,305	20.00
1891	484	719,328	19,014	13	4,778	123	325	238,123	4,790	822	962,229	20,927	20.00
1892	449	692,726	18,345	6	3,000	51	358	259,482	5,228	813	955,208	23,624	20.00
1893	445	667,848	16,970	7	2,761	59	330	255,632	4,796	775	923,480	21,946	22.12
1894	445	691,603	17,354	6	3,877	58	258	222,383	4,152	709	917,863	21,564	......
1895	467	732,707	18,045	5	3,680	46	235	204,177	3,598	707	940,564	21,689	20.07
1896	421	697,577	17,502	7	4,884	58	269	253,754	4,359	697	956,215	21,919	22.50
1897	442	734,716	18,655	8	4,236	153	297	315,120	5,242	747	1,054,072	24,050	23.50

CLEARED.

													Feet.
1873	466	398,050	13,749	65	30,102	669	224	129,164	3,194	755	557,316	17,632	17.50
1874	480	407,295	12,748	71	40,397	822	229	145,038	3,437	780	592,730	17,007	17.50
1875	319	234,831	9,376	72	39,311	804	195	128,086	2,924	586	452,228	13,404	17.50
1876	410	361,999	11,222	80	49,483	1,163	185	119,699	2,827	675	531,781	15,212	17.75
1877	400	439,370	12,081	65	44,829	1,066	161	103,342	2,489	626	587,541	15,736	18.25
1878	378	418,958	10,475	64	40,128	1,255	260	183,757	5,375	702	642,843	17,105	18.50
1879	365	442,734	8,834	36	24,891	497	223	156,470	3,129	624	624,095	12,460	17.75
1880	310	434,864	10,108	26	12,536	271	242	168,255	3,446	578	615,655	13,825	18.33
1881	369	508,422	11,458	22	13,052	253	261	180,579	3,745	652	702,053	15,456	19.00
1882	350	506,213	11,917	23	9,155	205	209	135,375	3,023	582	650,743	15,145	19.00
1883	355	415,720	9,780	10	4,115	90	165	87,400	2,015	530	507,235	11,885	18.25
1884	360	452,802	13,363	15	5,634	131	288	194,075	4,315	663	652,411	17,809	19.00
1885	414	502,773	14,672	20	8,722	148	228	154,858	3,344	662	666,353	18,164	20.17
1886	378	473,134	13,912	3	939	24	262	194,793	3,970	643	668,867	17,906	20.00
1887	380	480,030	14,167	4	678	29	269	202,656	4,186	653	683,364	18,382	20.00
1888	382	507,075	14,231	8	2,583	63	233	167,836	3,557	623	677,494	17,851	......
1889	395	540,293	15,505	7	1,323	51	307	226,181	4,601	711	767,747	20,157	......
1890	452	663,227	18,815	14	4,087	161	323	248,013	5,078	789	915,327	24,054	20.75
1891	445	676,900	18,200	4	9,909	208	339	271,067	5,429	788	957,876	23,837	20.75
1892	453	685,620	18,235	7	1,766	48	353	263,166	5,151	813	950,252	23,484	21.60
1893	411	622,381	16,190	9	4,059	75	338	282,680	5,524	749	905,061	21,714	21.75
1894	403	636,202	16,425	4	1,555	32	311	289,882	5,155	718	927,639	21,612	22.50
1895	412	643,303	16,642	2	718	21	297	303,534	5,220	711	947,555	21,883	23.02
1896	366	623,966	16,293	6	2,763	57	311	315,615	5,310	683	942,344	21,660	23.60
1897	386	668,946	17,680	6	2,534	55	338	373,714	6,137	730	1,045,194	23,872	24.00

Arrival and clearance of vessels and commerce at Savannah, Ga., etc.—Continued.

COMMERCE.

Year.	Value of exports.	Value of imports.	Duties collected.
1877	$32, 103, 853	$36, 307, 908	$34, 959. 93
1878	40, 028, 988	42, 948, 465	23, 364. 35
1879	40, 901, 421	43, 064, 472	27, 778. 73
1880	47, 836, 411	45, 522, 480	78, 458. 41
1881	58, 985, 901	48, 716, 900	356, 550. 22
1882	52, 004, 248	45, 952, 105	61, 148. 70
1883	53, 915, 934	47, 699, 796	65, 245. 34
1884	46, 425, 513	49, 112, 316	49, 147. 28
1885	48, 313, 216	49, 313, 216	45, 161. 40
1886	51, 033, 190	51, 118, 524	35, 455. 53
1887	54, 774, 082	52, 659, 223	48, 837. 12
1888	$56, 435, 601	$53, 412, 920	$98, 213. 75
1889	62, 892, 429	55, 062, 710	58, 815. 54
1890	84, 584, 326	68, 229, 825	57, 542. 57
1891	83, 367, 157	67, 248, 000	56, 714. 50
1892	67, 211, 175	54, 119, 194	47, 687. 00
1893*a*	23, 535, 503	450, 378	56, 664. 90
1894*a*	21, 374, 516	372, 525	47, 616. 67
1895*a*	21, 690, 283	273, 305	58, 582. 49
1896*a*	22, 689, 611	349, 237	36, 149. 81
1897*a*	28, 937, 655	379, 089	46, 697. 24

a Foreign only.

JOHN H. DEVEAUX,
Collector of Customs.

O 2.

IMPROVEMENT OF SAVANNAH RIVER, GEORGIA.

The Savannah River is formed by the junction of the Tugaloo and Keowee, and flows in a southeasterly direction to the sea.

A detailed description of the river is found in House Ex. Doc. No. 213, Fifty-first Congress, first session, and in Appendix O 2, Annual Report of the Chief of Engineers for 1890, pages 1328–1363.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 4 to 5 feet of water, but during the low-water season there are various shoals in the upper part of the river with low-water depths of less than 3 feet. The chief obstruction to navigation consists of sand and gravel bars, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The original plan for improving the Savannah River was submitted in 1880, and is given in Appendix J of the Annual Report of the Chief of Engineers for 1881.

The revised plan of improvement, as outlined in my predecessor's report of June 30, 1890, provides for the establishment of a navigable steamboat channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah.

This is to be accomplished by (1) removing sand and gravel bars; (2) regulating portions of the river, revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the channel, and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated, in round numbers, at $332,000, provided funds are regularly and adequately supplied.

From $3,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

For a summary of the work done under the original project of improvement, see page 1520 of the Annual Report of the Chief of Engineers for 1891; for a summary of the work done under the revised plan of improvement from 1891 to 1896, see page 1503 of the same officer's Annual Report for 1897; and for a summary of the work done under the same project in the fiscal year 1897, see the same report, page 1504.

The total expenditures under the present project, up to June 30, 1897, were $81,397.14.

CONDITION OF WORK JUNE 30, 1897.

The channel was in fair condition. A number of snags, however, had been lodged in it by the freshets, that required removal.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

Snagging operations were commenced by the snag boat *Satilla* on August 9, and continued until August 20. During this period there were removed between Purysburg (station 23 miles) and the Port Royal Railroad bridge (station 198 miles) 153 snags and stumps and 92 overhanging trees; 8 logs were cut up on bank and 12 pounds of explosives were used.

CONDITION OF WORK JUNE 30, 1898.

At the end of snagging operations (August 20), the river was in good condition for boating at ordinary low water. Since that time, however, a number of snags have been lodged in the channel, that require removal.

COMMERCE AND NAVIGATION.

A detailed statement of the sources of the commerce of this river is given on page 1331 of the Annual Report of the Chief of Engineers for 1890. Further information is given on page 1504 of the same officer's report for 1897.

During the calendar year 1897 there were five steamers engaged in the river traffic, which carried about 48,000 tons of freight, valued, according to a low estimate, at $1,730,000.

No data were available in regard to the timber rafted down the river in 1897.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga.

Savannah is the nearest port of entry. Amount of duties collected in 1897, $46,697.24. Forts Oglethorpe and Pulaski are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

It is proposed to expend any funds that may become available during the coming fiscal year in the removal of obstructions and in the construction of contracting works, according to the project of 1890.

The sum of $50,000 can be economically and advantageously expended during the coming year.

No permanent improvement can be expected, as new obstructions caused by logs and snags form during every freshet stage. They should, however, diminish in number from year to year.

Money statement.

July 1, 1897, balance unexpended	$8,622.77
June 30, 1898, amount expended during fiscal year	1,579.09
July 1, 1898, balance unexpended	7,043.68
Amount (estimated) required for completion of existing project	270,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of the Savannah River, adopted in 1880, the following appropriations were made:

By act of Congress of—	
March 3, 1881	$15,000.00
August 2, 1882	25,000.00
July 5, 1884	15,000.00
August 5, 1886	15,000.00
August 11, 1888	21,000.00
	91,000.00
Unexpended balance from last appropriation, carried to new project	19.91
Total	90,980.09
Received from other appropriations for use of snag boat	2,500.00
Aggregate	93,480.09

Since the existing project for improving the Savannah River was adopted the following appropriations have been made for this work:

By act of Congress—	
August 11, 1888 (balance unexpended)	$19.91
September 19, 1890	25,000.00
July 13, 1892	35,000.00
August 17, 1894	15,000.00
June 3, 1896	15,000.00
Total	90,019.91

O 3.

IMPROVEMENT OF SAVANNAH RIVER ABOVE AUGUSTA, GEORGIA.

The Savannah River is formed by the junction of the Tugaloo and Keowee rivers and flows in a southeasterly direction to the sea. Above the city of Augusta the river is navigable only by pole boats.

A detailed description of this river is given in House Ex. Doc. No. 213, Fifty-first Congress, first session.

ORIGINAL CONDITION.

The Savannah River above the city of Augusta has a very steep slope, and the obstacles to navigation are not only very numerous and extensive but at places quite dangerous. They consist of rock ledges, isolated bowlders, and bars of sand and gravel, with minimum low-water depths of less than 1 foot.

PLAN OF IMPROVEMENT.

The original plan for improving the Savannah River above Augusta was submitted in 1879, and is given in Appendix I of the Annual Report of the Chief of Engineers for 1879.

The revised plan of improvement, as outlined in my predecessor's report of January 31, 1890, provides for the establishment between Petersburg and the Locks of a downstream channel 12 to 25 feet in width and navigable during ordinary summer low water (or from nine to ten months of every year) for pole boats drawing 2 feet, and of an upstream channel navigable under the same conditions for pole boats drawing 1.3 feet of water.

This is to be obtained by (1) removing logs and overhanging trees; (2) excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; (3) constructing training walls to increase flow of water through sluices. The cost of improvement is estimated at $23,000, provided the money is all made available at once, or at $33,000 if supplied in smaller amounts.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

For a special history of work done under the original project see page 1032 of the Annual Report of the Chief of Engineers for 1888. For a summary of the work done under the revised project see pages 1506 and 1507 of the same officer's report for 1897.

The total expenditures under the present project up to June 30, 1897, were $15,770.91.

CONDITION OF WORK JUNE 30, 1897.

The channel was in fair condition. A number of snags, however, had been lodged in it by the freshets, and required removal.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

No work was done during the fiscal year just ended.

CONDITION OF WORK JUNE 30, 1898.

The channel is considerably obstructed and requires clearing very much.

COMMERCE AND NAVIGATION.

A detailed statement of the commerce tributary to this river is given in my report on the examination and survey of the river, printed as House Ex. Doc. No. 213, Fifty-first Congress, first session.

The freight carried on the river consists principally of cotton, grain, fertilizers, and general merchandise. In 1897 it amounted to about 1,500 tons, not including timber.

MISCELLANEOUS.

The work is located in the collection district of Savannah, Ga. Savannah is the nearest port of entry. Amount of duties collected in 1897, $46,697.24. Forts Oglethorpe and Pulaski are the nearest forts, and the nearest light-houses are those upon the river below Savannah.

Money statement.

July 1, 1897, balance unexpended	$3,229.09
July 1, 1898, balance unexpended	3,229.09
Amount (estimated) required for completion of existing project	14,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	1,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of Savannah River above Augusta, adopted in 1879, the following appropriations were made:

By act of Congress of—	
June 14, 1880	$16,000
March 3, 1881	8,000
August 2, 1882	15,000
Total	39,000

Since the existing project for improving this portion of Savannah River was adopted the following appropriations have been made for this work:

By act of Congress of—	
July 13, 1892	$10,000
August 18, 1894	6,000
June 3, 1896	3,000
Total	19,000

O 4.

IMPROVEMENT OF DARIEN HARBOR, GEORGIA.

About 12 miles above the town of Darien the Altamaha River divides into several branches. The northerly main branch forms the Darien River. That portion of Darien River between Darien and Doboy Sound is known as Darien Harbor.

Operations for improving this harbor have been carried on in accordance with a project of improvement submitted to the Chief of Engineers by General Gillmore, the officer then in charge, dated January 30, 1885, and printed as Appendix N 16, Annual Report of the Chief of Engineers for 1885.

ORIGINAL CONDITION.

Darien Harbor, in its original condition, was more or less obstructed at seven points by shoals, on which were found minimum mean low-water depths of from 6.4 to 10.6 feet. The shoals covered a total distance of 9.7 miles. The reaches between the shoals carried depths nowhere less than 12 feet at mean low water. The mean rise and fall of tide in the harbor is about 6.5 feet.

PLAN OF IMPROVEMENT.

The original plan of improvement submitted in 1885 and adopted in 1890 contemplates the establishment of a navigable channel between Darien and Doboy with a minimum mean low-water depth of 12 feet. This is to be accomplished by dredging to a minimum depth of 12.5 feet, and by the construction of wing dams at five of the shoals for maintaining the depth of the improved channel.

The estimated cost of the improvement is $170,000.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

For a summary of past work see pages 1508 and 1509 of the Annual Report of the Chief of Engineers for 1897.

The total expenditures under the present project up to June 30, 1897, were $94,883.59.

CONDITION OF WORK JUNE 30, 1897.

The works of construction were all in good condition, but some settlement had taken place. The practicable channel depth was nowhere less than 11½ feet at mean low water, excepting at Shoal No. 1 (opposite Doboy), where no work had been done and where the channel depth was only about 9½ feet.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

On April 9, 1897, the Secretary of War allotted $900 for the purpose of removing the wreck of a wooden vessel and a raft of logs from the channel at Brown John Shoal. As far as they extended into and obstructed the channel, both were removed by the U. S. snag boat *Satilla* between the 1st and 10th of September, 1897. The cost of the work was $591.07, and the unexpended balance of $308.93 was returned to the Treasurer of the United States.

No other work was done in Darien Harbor during the fiscal year just ended.

CONDITION OF WORK JUNE 30, 1898.

No survey has been made recently, but as far as known the channel has not deteriorated.

COMMERCE AND NAVIGATION.

For information in regard to the sources and the avenues of the commerce of this port, see page 1510 of the Report of the Chief of Engineers for 1897.

In 1897 the total annual trade amounted to about 165,000 tons, valued at $1,090,000, not including a large amount of timber passing through Darien Harbor.

Money statement.

July 1, 1897, balance unexpended	$116.41
June 30, 1898, amount expended during fiscal year	116.41
Amount (estimated) required for completion of existing project	75,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	25,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

MISCELLANEOUS.

The work is situated in the collection district of Brunswick, Ga. Darien is the nearest port of entry. Amount of duties collected in Brunswick in 1897, $18,586.57; at Darien, $6,060.88. Sapelo Light is the nearest light-house, and Forts Oglethorpe and Pulaski are the nearest forts.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

The first appropriation (which was expended in dredging) was made by act of Congress of June 18, 1878, $8,000.

Under the existing project of improvement the following appropriations have been made for this work:

By act of Congress of—	
September 19, 1890	$25,000
July 13, 1892	25,000
August 18, 1894	25,000
June 3, 1896	20,000
Total	95,000

COMMERCIAL STATISTICS.

Arrivals and clearances of vessels at Darien, Ga., from January 1, 1875, to December 31, 1897.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
1875	77	28, 053	647	....	....	....	92	47, 600	1, 198	169	75, 663	1, 845	22
1876	65	23, 105	611	....	....	....	124	70, 368	1, 897	189	93, 473	2, 508	21
1877	104	24, 827	1, 257	3	674	22	99	50, 913	1, 231	206	106, 414	2, 510	20
1878	61	29, 264	641	2	1, 051	20	126	60, 109	1, 628	189	90, 424	2, 289	20
1879	58	23, 275	487	3	4, 199	25	115	57, 710	1, 407	176	82, 184	1, 919	19½
1880	66	21, 539	489	1	688	13	134	68, 072	1, 608	201	90, 270	2, 140	19½
1881	101	40, 619	849	3	1, 220	29	162	84, 457	1, 991	166	126, 295	2, 869	19½
1882	117	48, 208	999	1	455	9	90	51, 421	1, 155	208	100, 082	2, 163	19
1883	95	38, 173	815	....	....	....	93	49, 290	1, 135	188	87, 963	1, 950	19
1884	81	34, 412	714	2	606	16	92	50, 178	1, 133	175	85, 193	1, 863	19
1885	78	27, 763	691	2	652	16	80	42, 587	975	160	71, 002	1, 673	18½
1886	108	44, 389	852	....	....	....	42	20, 772	483	150	65, 161	1, 335	19
1887	127	57, 035	1, 059	5	2, 349	45	26	13, 023	298	158	72, 407	1, 402	....
1888	185	76, 645	1, 558	1	402	9	22	13. 423	273	208	91, 470	1, 840	18½
1889	145	69, 763	1, 341	7	4, 349	62	61	19, 837	453	213	93, 949	1, 856	13½
1890	169	58, 058	1, 158	5	1, 964	41	28	10, 860	308	202	70, 222	1, 507	18½
1891	137	56, 818	1, 124	6	2, 377	46	24	17, 853	308	167	77, 048	1, 478	....
1892	168	69, 627	1, 369	1	353	7	25	17, 446	334	194	87, 426	1, 710	18½
1893	134	58, 310	1, 076	4	1, 918	33	33	31, 417	486	171	91, 640	1, 595	18½
1894	81	39, 158	653	3	1, 215	23	58	52, 751	852	142	95, 124	1, 528	17
1895	131	65, 317	1, 121	3	1, 228	23	46	44, 213	702	180	110, 668	1, 846	17
1896	92	42, 024	717	1	342	8	55	53, 499	876	148	95, 523	1, 591	....
1897	86	45, 740	821	7	2, 782	54	97	94, 678	1, 473	190	143, 200	2, 348	....

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.			Greatest draft.
				American vessels.			Foreign vessels.						
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	
													Feet.
1875	22	12, 214	328	11	4, 055	97	104	55, 759	1, 372	137	72, 028	1, 797	22
1876	39	9, 300	270	4	1, 553	32	180	87, 489	2, 263	223	98, 342	2, 565	21
1877	44	13, 209	314	4	842	21	169	92, 795	2, 154	217	106, 846	2, 489	20
1878	28	7, 842	181	6	3, 000	62	149	83, 385	1, 947	183	94, 236	2, 190	20
1879	40	14, 052	301	7	2, 765	57	125	65, 433	1, 538	172	82, 250	1, 896	19½
1880	55	17, 076	393	7	3, 589	72	168	84, 172	2, 016	230	194, 837	2, 481	19½
1881	80	28. 492	617	8	3, 120	70	184	95, 353	2, 164	272	126, 965	2, 851	19½
1882	93	34, 098	709	6	1, 962	46	115	63, 525	1, 434	214	99, 585	2, 189	19
1883	66	25, 019	510	9	3, 533	72	108	56, 411	1, 340	183	84, 963	1, 931	19
1884	59	20, 637	457	11	3, 977	85	119	66, 337	1, 478	189	90, 951	2, 020	19
1885	46	16, 649	339	8	3, 354	62	98	52, 742	1, 198	152	72, 745	1, 599	18½
1886	93	38, 295	719	10	3, 682	80	50	24, 376	564	153	66, 358	1, 363	19
1887	126	55, 592	1, 016	12	1, 144	17	16	8, 612	189	144	65. 700	1, 222	....
1888	155	64, 749	1, 318	2	538	15	36	23, 742	453	193	89, 029	1, 786	19
1889	155	63, 347	2, 091	6	4, 333	66	46	26, 488	528	207	94, 168	2, 685	....
1890	171	58, 810	1, 174	3	962	23	31	15, 569	336	205	75, 351	1, 533	....
1891	127	53, 890	1, 031	3	896	20	26	18, 006	256	156	72, 792	379	....
1892	161	69, 488	1, 310	2	917	16	33	21, 502	418	196	91, 807	1, 744	....
1893	137	56, 297	1, 115	1	300	6	46	40, 150	630	184	96, 747	1, 751	....
1894	75	33, 478	583	1	479	8	61	57, 772	894	137	91, 689	1, 485	17
1895	124	55, 829	970	1	817	16	53	51, 599	818	178	108, 245	1, 804	17
1896	93	41, 900	705	....	....	....	62	59, 594	926	155	101, 494	1, 631	....
1897	80	23, 750	593	....	....	....	95	94, 742	1, 500	175	128, 492	2, 093	....

Timber shipments from port of Darien, Ga., from January 1, 1875, to December 31, 1897.

Year.	Foreign.		Coastwise.		Total.	
	Superficial feet.	Value.	Superficial feet.	Value.	Superficial feet.	Value.
1875	41, 447, 024	$557, 524	10, 992, 600	$181, 377	52, 439, 624	$738, 901
1876	60, 762, 000	735, 099	8, 370, 000	138, 105	69, 132, 000	873, 204
1877	64, 378, 000	776, 856	11, 888, 100	196, 153	76, 266, 100	973, 010
1878	59, 697, 124	716, 365	7, 057, 800	116, 454	66, 754, 924	832, 819
1879	47, 217, 818	566, 613	12, 646, 800	208, 672	59, 804, 618	775, 285
1880	74, 612, 520	895, 350	15, 368, 500	253, 579	89, 981, 020	1, 148, 929
1881	65, 420, 876	785, 050	25, 642, 800	423, 106	91, 063, 676	1, 208, 156
1882	36, 639, 379	439, 672	30, 688, 200	506, 355	67, 327, 579	946, 027
1883	42, 385, 000	508, 620	22, 517, 100	371, 532	64, 902, 100	880, 152
1884	50, 656, 000	607, 872	18, 573, 300	306, 459	69, 229, 300	914, 331
1885	40, 101, 000	501, 262	14, 984, 100	247, 938	55, 085, 100	749, 200
1886	19, 960, 000	219, 500	24, 465, 000	661, 440	54, 425, 000	870, 940
1887	12, 023, 611	138, 476	50, 349, 600	912, 220	62, 373, 211	1, 056, 960
1888	17, 975, 371	215, 705	65, 998, 200	1, 121, 960	83, 975, 571	1, 337, 665
1889	20, 772, 265	237, 652	50, 667, 660	760, 144	71, 449, 865	997, 816
1890	10, 962, 017	140, 746	68, 223, 683	949, 762	79, 185, 700	1, 090, 508
1891	13, 785, 333	274, 674	45, 519, 707	910, 718	59, 305, 040	1, 185, 392
1892	12, 893, 730	179, 616	49, 708, 879	1, 093, 595	62, 602, 609	1, 273, 211
1893	33, 300, 000	399, 600	41, 375, 100	827, 502	74, 675, 100	1, 227, 102
1894	47, 910, 319	583, 671	30, 094, 750	571, 789	78, 004, 519	1, 155, 460
1895	39, 602, 963	426, 451	44, 660, 000	803, 880	84, 262, 963	1, 228, 331
1896	43, 059, 139	461, 148	34, 150, 251	341, 502	77, 209, 390	802, 650
1897	74, 170, 144	763, 557	27, 000, 000	324, 000	101, 170, 144	1, 087, 557

Commerce.

Year.	Value of exports.	Value of imports.	Total collections.
1880	$1, 621, 904	$5, 600	$11, 806. 72
1881	1, 137, 490	3, 356	18, 980. 02
1882	1, 073, 008	1, 025	11, 254. 19
1883	969, 834	2, 334	11, 067. 37
1884	1, 038, 185	11	9, 688. 20
1885	860, 500	....	2, 359. 01
1886	1, 037, 330	....	1, 716. 46
1887	1, 221, 000	....	1, 060. 97
1888	2, 100, 000	2, 600	964. 13
1889	997, 816	....	1, 784. 03
1890	140, 746	....	968. 95
1891	1, 530, 000	....	1, 198. 28
1892	1, 452, 827	....	1, 500. 85
1893	1, 406, 718	....	1, 930. 21
1894	804, 972	....	3, 516. 70
1895	1, 228, 000	....	2, 631. 24
1896	802, 651	....	3, 353. 98
1897	1, 087, 557	....	6, 060. 88

O 5.

IMPROVEMENT OF ALTAMAHA RIVER, GEORGIA.

The Altamaha River is formed by the junction of the Oconee and Ocmulgee rivers in the southeastern part of Georgia, and flows in a southeasterly direction to the sea.

A detailed description of this river is given in Appendix O, Annual Report of the Chief of Engineers for 1890, pages 1327–1386.

ORIGINAL CONDITION.

The chief obstruction to the navigation of the Altamaha River consists in rock ledges, sand bars, overhanging trees, snags, and sunken logs. The rock ledges were confined to the upper portion of the stream, while the other obstructions were found throughout its entire course. The low-water depths at some points did not exceed 1 foot.

PLAN OF IMPROVEMENT.

The original plan for improving the Altamaha River was submitted in 1880, and is given in Appendix J of the Annual Report of the Chief of Engineers for 1881.

The revised plan of improvement, outlined in my predecessor's report of June 12, 1890, provides for the establishment of a navigable steamboat channel, 3 feet deep at ordinary summer low water, between the junction of the Oconee and Ocmulgee rivers and the town of Darien.

This is to be accomplished by (1) removing rock shoals and sand bars; (2) building deflecting dikes and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream; (4) revetting caving banks.

The cost of the improvement, as given in the project of 1890, is estimated in round numbers at $129,000, provided funds are regularly and adequately supplied.

From $3,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

For a history of work done under the original project see page 1246 of the Annual Report of the Chief of Engineers for 1889. For a summary of work done under the revised project see page 1514 of the same officer's report for 1897.

The total expenditures under the present project, up to June 30, 1897, amounted to $44,474.73.

CONDITION OF WORK JUNE 30, 1897.

The works of improvement were in good order. The channel was in fair condition, a number of snags, however, requiring removal. At Coupers Bar the channel had deepened to 2.3 feet along the training wall.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

No work was done during the fiscal year just ended.

CONDITION OF WORK JUNE 30, 1898.

The training wall at Beards Bluff has deteriorated to some extent. The other works are in about the same condition as at the close of the last fiscal year.

COMMERCE AND NAVIGATION.

For information in regard to the sources of the commerce of this river see page 1514 of the Report of the Chief of Engineers for 1897.

Aside from a very large amount of lumber and timber the commerce of the river (fertilizers, cotton seed, rosin, turpentine, general merchandise) has been estimated at 22,000 tons and valued at $540,000 for the calendar year 1897.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1897 $18,586.57. Sapelo Light is the nearest light-house, and Forts Oglethorpe and Pulaski are the nearest forts.

It is proposed to expend any funds that may become available during the coming fiscal year in the removal of obstructions and the improvement of the shoal places in the river according to the project of 1890.

The sum of $10,000 can be economically and advantageously expended during the coming year. No permanent improvement can be effected as new obstructions caused by logs and snags form during every freshet stage. They should, however, diminish in number from year to year.

Money statement.

July 1, 1897, balance unexpended	$5,748.68
June 30, 1898, amount expended during fiscal year	485.77
July 1, 1898, balance unexpended	5,262.91
Amount (estimated) required for completion of existing project	107,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of the Altamaha River, adopted in 1880, the following appropriations were made:

By act of Congress of—	
March 3, 1881	$5,000.00
August 2, 1882	15,000.00
July 5, 1884	20,000.00
August 5, 1886	20,000.00
August 11, 1888	10,000.00
	70,000.00
Unexpended balance of last appropriation carried to new project	223.41
Total	69,776.59

Since the existing project for improving Altamaha River was adopted in 1890 the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$223.41
September 19, 1890	15,000.00
July 13, 1892	15,000.00
August 18, 1894	10,000.00
June 3, 1896	10,000.00
Total	50,223.41

O 6.

IMPROVEMENT OF OCONEE RIVER, GEORGIA.

The Oconee River rises in the northeastern part of Georgia, flows in a southeasterly direction, and unites with the Ocmulgee to form the Altamaha. A detailed description of this river is given in House Ex. Doc. No. 211, Fifty-first Congress, first session.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 3 to 4 feet, but during the low-water season there are various shoals with low-water depths of not more than 2 feet. The chief obstructions to navigation consist of sand bars, rock shoals, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The original plan for improving the Oconee River was submitted in 1875 and is given in the Annual Report of the Chief of Engineers for that year. That plan was modified in 1878, 1880, and 1888.

The present plan of improvement, outlined in my predecessor's report of February 5, 1890, provides for the establishment of a navigable steamboat channel 3 feet deep at ordinary summer low water from Milledgeville to the river's mouth.

This is to be accomplished by (1) removing rafts, rock shoals, and sand bars; (2) enlarging portions of the river, revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement is estimated at $171,000, provided funds are regularly and adequately supplied.

From $1,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

For a history of work done under the original project of improvement see page 1253 of the Annual Report of the Chief of Engineers for 1889. For a summary of work done under the present project see pages 1516 and 1517 of the same officer's report for 1897.

The total expenditures under the present project up to June 30, 1897, amounted to $64,829.76.

CONDITION OF WORK JUNE 30, 1897.

The channel was left in good condition when work stopped, but at the end of the fiscal year 1897 a number of snags had been lodged in it which required removal.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

Snagging operations were commenced by the snag boat *Satilla* on March 31 and continued until June 24, when they were stopped and the boat tied up on account of the river being too low for work. During the period just mentioned the river was cleared from the forks up to a point about 4 miles below the Central Railroad bridge (Station 104 miles). There were removed 982 snags and stumps and 240 overhanging trees; 33 logs were cut up on bank, and 56 pounds of explosives were used.

CONDITION OF WORK JUNE 30, 1898.

From the Forks up to nearly the Central Railroad bridge the river is in good condition. Above that point it is very much obstructed and requires clearing.

COMMERCE AND NAVIGATION.

The Oconee River is navigable from the mouth to Milledgeville, a distance of about 147 miles. During the calendar year 1897 the boats plying the river carried about 22,550 tons of freight, valued at about

$800,000. In addition to this there were 90,000,000 feet B. M., or 180,000 tons, of pine and cypress timber, valued at about $690,000, rafted down the river. The total commerce of the river during the calendar year 1897 was therefore about 202,550 tons, valued at $1,490,000.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1897, $18,586.57. Sapelo Light is the nearest light-house, and Forts Oglethorpe and Pulaski are the nearest forts.

It is proposed to expend any funds that may become available during the coming fiscal year in the removal of obstructions and the improvement of the shoal places in the river, according to the project of 1890.

The sum of $10,000 can be economically and advantageously expended during the coming year. No permanent improvement can be expected, as new obstructions, caused by logs and snags, form during every freshet stage. They should, however, diminish in number from year to year.

Money statement.

July 1, 1897, balance unexpended	$5,371.42
June 30, 1898, amount expended during fiscal year	2,718.43
July 1, 1898, balance unexpended	2,652.99
Amount (estimated) required for completion of existing project	122,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the works of improvement were begun the following appropriations have been made:

By act of Congress of—	
June 18, 1878	$10,000.00
March 3, 1879	1,500.00
June 14, 1880	1,500.00
March 3, 1881	2,500.00
August 2, 1882	5,000.00
July 5, 1884	$3,000.00
August 5, 1886	9,000.00
August 11, 1888	12,500.00
	45,000.00
Unexpended balance from last appropriation carried to new project	201.18
Total	44,798.82

Since the existing project for improving the Oconee River was adopted the following appropriations have been made for this work:

By act of Congress of—	
August 11, 1888 (unexpended balance)	$201.18
September 19, 1890	25,000.00
July 13, 1892	25,000.00
August 18, 1894	$10,000.00
June 3, 1896	10,000.00
Total	70,201.18

O 7.

IMPROVEMENT OF OCMULGEE RIVER, GEORGIA.

The Ocmulgee River is formed by the junction of the South and Yellow rivers, about 20 miles below Covington, and flows thence in a southeasterly direction about 250 miles, where it unites with the Oconee to form the Altamaha. A detailed description of this river is found in House Ex. Doc. No. 215, Fifty-first Congress, first session.

ORIGINAL CONDITION.

For the greater part of the year the river is navigable for steamboats drawing from 3 to 4 feet, but during the low-water season there are various shoals with depths of not more than 2 feet. The chief obstructions to navigation consist of rock shoals, sand bars, overhanging trees, snags, and sunken logs.

PLAN OF IMPROVEMENT.

The original plan for improving Ocmulgee River was submitted in 1876, and is given in the Annual Report of the Chief of Engineers for that year. That project was revised in 1882 and again in 1886.

The present plan of improvement, outlined in my predecessor's report of February 5, 1890, provides for the establishment of a navigable steamboat channel 3 feet deep at oridinary summer low water from Macon to the river's mouth.

This is to be obtained by (1) removing rock shoals and sand bars; (2) closing incipient cut-offs and revetting caving banks; (3) removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement, as given in the project of 1890, is estimated at $210,000, provided funds are regularly and adequately supplied.

From $1,000 to $5,000 will be required for the annual maintenance of the completed work.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

For a history of the work done under the original project see page 1258 of the Annual Report of the Chief of Engineers for 1889. For a summary of the work done under the present project see pages 1519 and 1520 of the same officer's report for 1897.

The total expenditures under the present project up to June 30, 1897, amounted to $70,720.19.

CONDITION OF WORK JUNE 30, 1897.

The channel was in fair condition; a number of snags, however, required removal.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

Snagging operations were commenced by the snag boat *Satilla* on September 22 and continued until March 23, at which time the entire river from the forks up to Macon had been cleared and put into good condition. There were removed 199 snags and stumps and 4,738 overhanging trees; 69 logs were cut up on bank, and 224½ pounds of explosives were used.

On January 10 the Department made a special allotment of $500 for the purpose of removing the wreck of the steamer *Allen* from the channel just above the mouth of Stone Creek. The work was done by the U. S. snag boat *Satilla* between the 17th and the 20th of January, at a cost of $113.07. The wreck was broken up and entirely removed, the boiler and engines being taken out and deposited on the bank and afterwards turned over to the owner, Mr. W. A. Roush, who paid the cost of their removal. This amount, $56.54, was deposited to the credit of the

Treasurer of the United States. The unexpended balance of the allotment, amounting to $386.93, was likewise turned over to that officer.

CONDITION OF WORK JUNE 30, 1898.

Since the completion of snagging operations the channel has become somewhat obstructed by snags, etc., and it now stands in need of further clearing.

COMMERCE AND NAVIGATION.

A detailed discussion of this subject will be found on pages 1478 to 1484 of the Report of the Chief of Engineers for 1890, and page 1520 of the same officer's report for 1897. No data are available for the amount and value of last year's trade.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1897, $18,586.57. Sapelo Light is the nearest light-house, and Forts Oglethorpe and Pulaski are the nearest forts.

It is proposed to expend any funds that may become available during the present fiscal year in the removal of obstructions and in the improvement of the shoals in the river between Macon and the river's mouth, according to the project of 1890.

The sum of $10,000 can be economically and advantageously expended during the coming year. No permanent improvement can be effected, as new obstructions, caused by logs and snags, form during every freshet stage. They should, however, diminish in number from year to year.

Money statement.

July 1, 1897, balance unexpended	$4,524.76
June 30, 1898, amount expended during fiscal year	4,463.76
July 1, 1898, balance unexpended	61.00
Amount (estimated) required for completion of existing project	156,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project of improvement of the Ocmulgee River, adopted in 1876, the following appropriations were made:

By act of Congress of—		By act of Congress of—	
August 14, 1876	$15,000.00	July 5, 1884	$3,000.00
June 18, 1878	15,000.00	August 5, 1886	7,500.00
March 3, 1879	7,000.00	August 11, 1888	15,000.00
June 14, 1880	7,000.00		79,500.00
March 3, 1881	5,000.00		
August 2, 1882	5,000.00		
Unexpended balance carried forward from last appropriation to new project			224.95
Total			79,275.05

Since the existing project for improving Ocmulgee River was adopted the following appropriations have been made for the work:

By act of Congress of—		By act of Congress of—	
August 11, 1888 (unexpended balance)	$224.95	August 18, 1894	$10,000.00
September 19, 1890	30,000.00	June 3, 1896	10,000.00
July 13, 1892	25,000.00	Total	75,244.95

O 8.

IMPROVEMENT OF BRUNSWICK HARBOR, GEORGIA.

About 2 miles above the city of Brunswick Turtle River is divided by Buzzard Island into two branches, the smaller one, flowing to the eastward of the island and upon which the city of Brunswick is situated, being known as East River, the other retaining the name of Turtle River. These streams unite again about 1½ miles below the city to form Brunswick River. The lower part of East River forms what is known as the harbor of Brunswick. Operations for the improvement of this harbor have been carried on in accordance with a project of improvement prepared by General Gillmore, the officer then in charge, and printed as Appendix M 12, Annual Report of the Chief of Engineers for 1886. This project is an enlargement and a modification of a previous one submitted by the same officer and printed as Appendix J 7, Annual Report of the Chief of Engineers for 1880.

ORIGINAL CONDITION.

Turtle and Brunswick rivers have low-water depths of from 4 to 6 fathoms. Over the shoal in East River in front of the city there was, when the existing project of improvement was adopted, a low-water depth of only 1½ fathoms. The mean rise and fall of tide is about 6.6 feet.

PLAN OF IMPROVEMENT.

The following comprise the main features of the plan of improvement:

(1) A training wall projecting from the most easterly point of Buzzard Island and located approximately parallel to and 1,000 feet or less distant from the opposite shore of East River.

(2) A low dam across Turtle River extending obliquely upstream from the upper end of Buzzard Island to the opposite shore of Blythe Island.

(3) Short spur jetties in the lower part of East River.

(4) Dredging in the vicinity of Turtle River Dam and on the shoal in the lower part of East River.

The training walls and spurs were to be constructed of palmetto cribs loaded with stone or of successive courses of log and brush mattresses loaded with riprap stone. The works were intended to establish and maintain a 15-foot low-water channel across the shoal in East River. The cost of the original project was estimated at $73,187.50, and as modified at $190,000.

In 1836 an appropriation of $10,000 was made for the removal of the shoal in East River. Since the adoption of the modified project nine appropriations have been made by Congress for the work, aggregating $190,000. Two additional appropriations of $10,000 and $15,000 were made for maintenance, one in 1894 and the other in 1896.

In my predecessor's report of November 26, 1894, concerning a revision of the project of improving harbor at Brunswick, he stated that—

> It will be more economical and advantageous to maintain the desired depth of 15 feet at mean low water by keeping the training wall in good condition and by annual dredging than by constructing a dam across Turtle River and further channel contraction.

He also estimated the cost of maintenance at $15,000 per annum, provided that sum be made available each year.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

For a summary of past work see page 1274 of the Report of the Chief of Engineers for 1896, and page 1523 of the same officer's Annual Report for 1897.

The total expenditures under the present project, up to June 30, 1897, were $18,268.34.

CONDITION OF WORK JUNE 30, 1897.

The training wall was in good condition, although some settlement had taken place. The deepening of the channel along the city front and in Academy Creek, by dredging, was nearly completed.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

Dredging under contract of September 25, 1896, with Rittenhouse R. Moore, was continued until July 15, when the work was completed. The channel along the city front had been deepened to 15½ feet, and the channel in Academy Creek had been deepened to 12½ feet. There were removed from the former 3,106.5 cubic yards of material, and there were removed from the latter 8,251.5 cubic yards of material, making a total of 11,358 cubic yards removed during the fiscal year.

On January 8, 1898, the sum of $500 was allotted for the purpose of removing the wreck of the steamer R. L. Mabey. An additional allotment of $500 for the same purpose was made on March 24.

The wreck was removed by W. M. Tupper & Co., of Brunswick, Ga., under their proposal, accepted March 25, 1898, to do the work for $895. The wreck was lifted bodily and placed in shallow water entirely out of the channel. Work was begun March 28 and completed April 6, 1898. The unexpended balance of $105 was returned to the Treasurer of the United States.

CONDITION OF WORK JUNE 30, 1898.

No examination of Brunswick Harbor has recently been made, but as far as known the training wall is in fair condition and the channel has not deteriorated. It is not quite uniform in depth. A moderate amount of dredging will remedy this.

COMMERCE AND NAVIGATION.

Information in regard to the commerce of Brunswick before the improvement will be found on page 1523 of the Report of the Chief of Engineers for 1897. Since 1880 the annual tonnage of the port and its value have grown very much, the shipments of cotton, for instance, having increased from 4,000 bales in 1885 to 200,541 bales in 1897.

Besides a line of steamers to New York and several lines to points in Georgia and Florida, a large fleet of foreign and coastwise steam and sailing vessels is engaged in the Brunswick trade, which consists principally of shipments of cotton, naval stores, lumber, ties, and phosphates.

MISCELLANEOUS.

The work is located in the collection district of Brunswick, Ga. Amount of duties collected in 1897, $18,586.57. St. Simons Light is the nearest light-house, and Fort Clinch, Fla., the nearest fort.

The sum of $10,000 can be economically and advantageously expended during the coming fiscal year in maintaining the present channel depths by dredging.

Money statement.

July 1, 1897, balance unexpended	$6,731.66
June 30, 1898, amount expended during fiscal year	6,107.22
July 1, 1898, balance unexpended	624.44
Amount (estimated) required for completion of existing project	(*)
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the work of improvement was begun the following appropriations have been made:

By act of Congress of—	
July 4, 1836	$10,000
March 3, 1879	20,000
June 14, 1880	10,000
March 3, 1881	5,000
August 2, 1882	25,000
July 5, 1884	10,000

By act of Congress of—	
August 5, 1886	$22,500
August 11, 1888	35,000
September 19, 1890	35,000
July 13, 1892	27,500
Total	200,000

For maintenance:	
August 18, 1894	10,000
June 3, 1896	15,000
Aggregate	225,000

Abstract of bids opened at Savannah, Ga., September 8, 1896, by Capt. O. M. Carter, Corps of Engineers, for dredging in Darien Harbor, Brunswick Harbor, and Inside Water Route, between Savannah and Fernandina.

No.	Name and address of bidder.	Dredging in Darien Harbor, Georgia (75,000 cubic yards).		Dredging in Brunswick Harbor, Georgia (60,000 cubic yards).		Dredging along Inside Water Route (75,000 cubic yards).		Total.
		Price.	Amount.	Price.	Amount.	Price.	Amount.	
1	Savannah Dredging Co., Jacob Paulsen, president, Savannah, Ga	$0.14	$10,500	$0.16	$9,600	$0.13½	$10,125	$30,225
2	Rittenhouse R. Moore, Mobile, Ala.[†]	.12	9,000	.14	8,400	.10	7,500	24,900
3	American Dredging Co., S. Y. Schermerhorn, president, Philadelphia, Pa.[‡]	.17	12,750	.18	10,800	.16	12,000	35,550
4	P. Sanford Ross, Jersey City, N. J	.15	11,250	.16	9,600	.14	10,500	31,350
5	Virginia Dredging Co., J. Clement Shafer, president, Richmond, Va.[§]	.17$\frac{9}{10}$	13,425	.17$\frac{9}{10}$	10,740	.17$\frac{9}{10}$	13,425	37,590

Amount available, $45,000.

[*] Indeterminate.

[†] Bid recommended for acceptance, he being the lowest responsible bidder for the best and most suitable material and services.

[‡] Evidence of authority to bid not filed.

[§] Certificate of guaranty omitted.

Contract in force.

Name and address of contractor.	Character of work.	Date of approval.	Work began.	Expires.
Rittenhouse R. Moore, Mobile, Ala	Dredging	Oct. 20, 1896	Apr. 20, 1897	Aug. 15, 1897

COMMERCIAL STATISTICS FOR 1897.

EXPORTS.

Articles.		Foreign.	Domestic (coastwise).
Cotton	bales	172, 036	28, 505
Cotton seed	tons	3, 574	
Yarn	bales		2, 584
Phosphate	tons	46, 378	341
Rosin	barrels	200, 323	64, 154
Turpentine	do	52, 968	10, 749
Lumber and timber	feet, B. M.	36, 150, 000	90, 688, 000
Cross-ties	number	23, 846	1, 394, 852
Shingles	do	1, 635, 050	10, 290, 948
Laths	do	10, 000	
Pig iron	tons	20, 432	3, 567
Oysters	cases		2, 020
Merchandise	tons		1, 599

	Tons.	Value.
Exports:		
Domestic (coastwise)	224, 000	$3, 888, 792. 00
Foreign	248, 000	8, 693, 322. 00
Imports	443, 294	5, 803, 110. 00
Total	915, 294	18, 385, 224. 00

Arrivals and clearances of vessels and commerce at Brunswick, Ga., from January 1, 1878, to December 31, 1897.

ARRIVED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878	116	32, 584	850	36	10, 218	270	41	19, 008	493	193	61, 810	1, 613
1879	148	44, 397	1, 000	33	8, 235	232	40	17, 589	468	221	70, 221	1, 790
1880	271	77, 656	1, 891	36	11, 219	317	39	14, 996	432	346	103, 871	2, 641
1881	279	100, 451	2, 239	13	4, 174	98	63	30, 279	751	355	134, 904	3, 088
1882	335	123, 149	2, 659	7	2, 095	57	63	26, 958	694	405	152, 202	3, 416
1883	299	110, 302	2, 368	11	4, 814	107	87	40, 765	979	397	155, 881	3, 454
1884	239	88, 063	1, 893	10	4, 434	88	126	62, 818	1, 435	375	155, 315	3, 416
1885	242	93, 280	1, 928	10	3, 216	76	94	43, 284	1, 037	346	139, 780	3, 052
1886	229	88, 244	1, 751	7	3, 262	48	98	47, 798	1, 164	334	139, 304	2, 835
1887	194	86, 731	1, 625	8	2, 251	116	102	54, 537	1, 232	304	144, 519	2, 973
1888	821	290, 590	3, 619	9	2, 991	76	147	80, 330	1, 729	977	373, 911	10, 424
1889	220	92, 831	1, 764	29	10, 035	176	191	113, 757	2, 403	431	216, 623	4, 343
1890	316	196, 701	3, 844	23	7, 513	186	126	71, 158	1, 559	465	275, 372	5, 589
1891	374	235, 565	5, 462	29	8, 025	164	107	70, 228	1, 523	501	313, 818	6, 149
1892	439	279, 998	4, 450	42	20, 548	354	134	85, 332	1, 812	615	385, 878	6, 616
1893	431	255, 367	4, 392	48	23, 384	371	123	93, 634	1, 710	602	372, 385	6, 473
1894	382	261, 315	4, 926	50	25, 382	393	173	147, 672	2, 675	605	434, 369	7, 994
1895	481	319, 399	5, 750	25	14, 867	242	147	112, 957	2, 089	653	447, 223	8, 081
1896	587	344, 045	6, 503	40	19, 999	359	134	63, 348	1, 852	761	427, 392	8, 714
1897	716	417, 847	7, 783	84	42, 543	717	260	232, 762	4, 158	1, 060	693, 143	12, 658

Arrivals and clearances of vessels and commerce at Brunswick, Ga., etc.—Continued.

CLEARED.

Year.	Coastwise.			Foreign ports.						Total.		
				American vessels.			Foreign vessels.					
	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.	No.	Tons.	Crew.
1878....	124	32, 767	874	28	9, 231	236	49	21, 218	550	201	63, 216	1, 660
1879....	157	42, 345	1, 116	21	7, 172	172	47	21, 730	555	225	71, 247	1, 843
1880....	270	78, 913	2, 010	14	5, 010	115	48	19, 970	550	332	103, 900	2, 675
1881....	252	82, 155	1, 732	17	7, 218	156	87	42, 659	1, 014	356	132, 932	1, 902
1882....	278	96, 170	2, 086	19	7, 761	170	101	48, 699	1, 139	398	152, 630	3, 395
1883....	257	91, 036	1, 962	28	11, 268	240	124	55, 717	1, 369	411	158, 021	3, 571
1884....	176	62, 927	1, 322	38	16, 209	335	148	70, 612	1, 633	362	149, 478	3, 290
1885....	196	71, 345	1, 481	21	8, 696	190	135	62, 437	1, 456	352	142, 478	3, 127
1886....	184	67, 020	1, 413	17	7, 528	159	117	56, 280	1, 305	318	130, 828	2, 877
1887....	130	51, 305	958	5	5, 858	143	121	72, 894	1, 526	276	130, 057	2, 627
1888....	785	266, 152	8, 240	13	4, 715	116	173	102, 300	2, 236	971	373, 227	10, 592
1889....	169	65, 809	1, 273	11	4, 266	103	221	130, 919	2, 830	401	200, 994	4, 206
1890....	247	122, 820	2, 024	18	8, 745	165	172	107, 197	2, 261	437	238, 762	4, 450
1891....	313	186, 171	3, 432	26	16, 045	234	141	94, 827	1, 980	480	297, 043	5, 646
1892....	390	247, 329	4, 228	19	6, 882	174	163	109, 728	2, 334	572	363, 939	6, 736
1893....	420	236, 856	4, 165	13	6, 857	121	159	119, 282	2, 266	590	362, 995	6, 552
1894....	363	235, 307	4, 481	14	6, 081	125	223	193, 483	3, 260	600	434, 871	7, 886
1895....	458	290, 702	5, 260	9	4, 155	103	182	148, 892	2, 811	649	443, 749	8, 174
1896....	591	323, 357	5, 759	18	8, 638	173	150	112, 446	2, 248	759	444, 441	8, 180
1897....	764	432, 089	6, 940	15	6, 155	117	274	246, 302	4, 326	1, 053	684, 546	11, 383

COMMERCE.

Year.	Value of exports.	Value of imports.	Total collection.	Year.	Value of exports.	Value of imports.	Total collection.
1878..........	$1, 372, 842	$400	$4, 500. 97	1888 *a*	$7, 552, 025	$3, 140, 231	$7, 438. 04
1879..........	1, 394, 401	3, 197	5, 644. 33	1889..........	7, 894, 281	6, 557	8, 933. 66
1880..........	1, 702, 570	8, 098	17, 723. 27	1890..........	7, 355, 841	7, 326	5, 748. 00
1881..........	2, 230, 000	4, 377	29, 305. 30	1891 *a*	9, 742, 553	3, 014, 207	5, 982. 07
1882..........	1, 700, 000	2, 734	20, 058. 90	1892..........	5, 372, 775	22, 988	6, 408. 15
1883..........	3, 437, 000	3, 093	24, 911. 61	1893 *a*	7, 297, 973	1, 680, 512	5, 768. 00
1884..........	3, 500, 000	958	19, 780. 32	1894 *a*	9, 940, 453	3, 549, 378	9, 141. 41
1885..........	3, 063, 960	4, 008	3, 939. 27	1895 *a*	7, 520, 404	3, 328, 407	7, 422. 10
1886..........	2, 828, 656	2, 397	5, 834. 43	1896..........	5, 727, 074	15, 072	8, 047. 11
1887 *a*	4, 121, 660	2, 815, 769	37, 520. 00	1897 *a*	12, 582, 114	5, 803, 110	18, 586. 57

a Coastwise and foreign.

Statement of receipts of naval stores.

Year.	Stock on hand.		Receipts for year.		Total.	
	Rosin.	Spirits.	Rosin.	Spirits.	Rosin.	Spirits.
	Barrels.	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*	*Barrels.*
1880	3, 000	600	36, 495	8, 661	39, 495	9, 261
1881	2, 935	240	67, 562	13, 490	70, 297	13, 730
1882	15, 191	2, 100	104, 357	23, 459	119, 548	25, 559
1883	19, 791	2, 200	80, 078	16, 105	99, 769	18, 305
1884	15, 236	893	105, 622	23, 449	120, 858	24, 342
1885	8, 016	1, 610	92, 958	30, 900	100, 974	22, 510
1886	11, 963	2, 786	139, 366	34, 625	151, 329	37, 410
1887	45, 337	1, 161	125, 546	32, 338	170, 883	33, 459
1888	27, 098	2, 420	140, 820	37, 643	167, 918	40, 063
1889	....	....	186, 000	45, 000	....	....
1890	31, 869	2, 259	212, 374	42, 813	244, 243	45, 073
1891	29, 421	1, 088	161, 402	42, 697	190, 823	43, 875
1892	30, 294	651	220, 250	52, 496	250, 544	53, 147
1893	20, 847	4, 005	172, 412	43, 100	193, 259	47, 105
1894	....	....	187, 912	46, 954	187, 912	46, 954
1895	35, 000	1, 500	268, 349	53, 329	303, 349	54. 829
1896	35, 507	1, 441	259, 103	66, 286	294, 610	67, 727
1897	57, 931	3, 694	323, 155	77, 441	381, 086	81, 135

O 9.

IMPROVEMENT OF THE INSIDE WATER ROUTE BETWEEN SAVANNAH, GEORGIA, AND FERNANDINA, FLORIDA.

The location of this route is shown by a dotted line on Coast Survey Charts Nos. 156 and 157, and a detailed description of it is given in Appendix N 12, Annual Report of the Chief of Engineers for 1892, pages 1311–1326. (See also subsequent reports.)

The distance from Savannah to Fernandina by the inside route just described is about 160 miles.

Touching at Darien en route increases the distance by about 20 miles, and at Brunswick by about 12 miles.

PLAN OF IMPROVEMENT.

The original project of improvement adopted in 1892 provides for the establishment of a channel 7 feet deep at mean low water between Savannah, Ga., and Fernandina, Fla. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek by means of dredging and the construction of closure dams and training walls of brush mattresses loaded with riprap stone. The estimated cost of the improvement is $105,000, provided that the entire sum is made at once available. If funds are made available in smaller amounts the cost of the improvement will be greatly increased.

SUMMARY OF OPERATIONS PRIOR TO JULY 1, 1897.

Up to this time operations had been entirely confined to Jekyl Creek. A summary of them will be found on page 1536 of the Annual Report of the Chief of Engineers for 1897.

The total expenditures up to June 30, 1897, were $36,489.49. Besides this the sum of $24,000, appropriated for the specific improvement of Jekyl Creek, had been expended for that purpose.

CONDITION OF WORK JUNE 30, 1897.

So far as known the training wall at the mouth of Jekyl Creek and the dredged channel at and near the same locality were in good condition.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

Work during the fiscal year was confined to Jekyl Creek and Mud River. Dredging under contract of September 25, 1896, with Rittenhouse R. Moore was commenced at the former place on July 16 and continued until July 31, when the work was completed. The channel inside was cut to a depth of 8 feet and a width of 45 feet, and the channel along the training wall over the flats at the mouth was cut to a depth of 7 feet and a width of 80 feet. There were removed 12,695.7 cubic yards of material at the former place and 8,891.1 cubic yards of material at the latter place, making in all 21,586.8 cubic yards of material removed from the channel at Jekyl Creek.

On August 11 dredging under the above-mentioned contract was commenced at Mud River, with a view of connecting the deep water of Sapelo Sound with that of New Tea Kettle Creek by a channel 7 feet deep at mean low water. One cut, about 5,800 feet long and from 40 to

45 feet wide, was made from Sapelo Sound into the mouth of Mud River (East Range). Two cuts, about 5,000 feet long each and aggregating from 80 to 90 feet in width, were to be made along the shore of Creighton Island (Middle Range), but had not been quite completed at the end of the fiscal year, a length of about 700 feet still remaining to be cut. One cut, 1,400 feet long and about 40 feet wide, was made from the shore of Creighton Island across Mud River to the mouth of New Tea Kettle Creek (south range). Work was continued to the end of the fiscal year, at which time 90,866.4 cubic yards of material had been removed.

In all there were removed from the channel on the Inside Route 112,453.2 cubic yards of material.

CONDITION OF WORK JUNE 30, 1898.

The training wall at the mouth of Jekyl Creek is in good condition. The channel in the creek is stated to have shoaled somewhat. In Mud River the single cut made on the east range is stated by local steamboat men to have shoaled somewhat, and to be not much used on account of its narrowness and the lack of suitable ranges.

COMMERCE AND NAVIGATION.

For a detailed discussion of the commerce over the inside route see pages 1323 and 1324 of the Annual Report of the Chief of Engineers for 1892; also, page 1536 of the same officer's Annual Report for 1897.

MISCELLANEOUS.

This work is located in the collection districts of Savannah, Brunswick, St. Marys, Ga., and Fernandina, Fla. The amount of duties collected in 1896 was: Savannah, $46,697.24; Brunswick, $18,586.57; St. Marys, unknown; and Fernandina, $418.86, respectively. No data for 1897 available. The nearest light-houses are those upon the Savannah River, near the beginning, and Amelia light at the end of the route, with Sapelo, Wolf Island ranges, St. Simon, and Little Cumberland lights between. Forts Oglethorpe and Pulaski, Ga., and Clinch, Fla., are the nearest forts.

All of the two first appropriations have been expended at Jekyl Creek. Four appropriations, aggregating $24,000, have also been made for the specific improvement of Jekyl Creek. That improvement has now been completed, but the sum of $2,500 will be required for annual maintenance.

The sum of $50,000 can be advantageously expended during the coming year.

Money statement.

July 1, 1897, balance unexpended		$12,510.51
June 30, 1898, amount expended during fiscal year		11,159.94
July 1, 1898, balance unexpended		1,350.57
July 1, 1898, outstanding liabilities	$540.95	
July 1, 1898, amount covered by uncompleted contracts	759.62	
		1,300.57
July 1, 1898, balance available		50.00
Amount (estimated) required for completion of existing project		56,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		50,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Since the existing project for improving this route was adopted three appropriations, aggregating $49,000, have been made, as follows:

By act of Congress of—	
July 13, 1892	$15,000
August 18, 1894	20,000
June 3, 1896	14,000
Total	49,000

Abstracts of bids opened at Savannah, Ga., September 8, 1896, by Capt. O. M. Carter, Corps of Engineers, for dredging in Darien Harbor, Brunswick Harbor, and inside water route between Savannah and Fernandina.

No.	Name and address of bidder.	Dredging in Darien Harbor, Georgia (75,000 cubic yards).		Dredging in Brunswick Harbor, Georgia (60,000 cubic yards).		Dredging along inside water route (75,000 cubic yards).		Total.
		Price.	Amount.	Price.	Amount.	Price.	Amount.	
1	Savannah Dredging Co., Jacob Paulsen, president, Savannah, Ga	$0.14	$10,500	$0.16	$9,600	$0.13½	$10,125	$30,225
2	Rittenhouse R. Moore, Mobile, Ala. *a*	.12	9,000	.14	8,400	.10	7,500	24,900
3	American Dredging Co., S. Y. Schermerhorn, president, Philadelphia, Pa. *b*	.17	12,750	.18	10,800	.16	12,000	35,550
4	P. Stanford Ross, Jersey City, N. J	.15	11,250	.16	9,600	.14	10,500	31,350
5	Virginia Dredging Co., J. Clement Shafer, president, Richmond, Va. *c*	.17$\frac{9}{10}$	13,425	.17$\frac{9}{10}$	10,740	.17$\frac{9}{10}$	13,425	37,590

a Bid recommended for acceptance, he being the lowest responsible bidder for the best and most suitable materials and services.
b Evidence of authority to bid not filed.
c Certificate to guarantee omitted.
Amount available, $45,000.

Contract in force.

Name and address of contractor.	Character of work.	Date of approval.	Work began.	Expires.
Rittenhouse R. Moore, Mobile, Ala	Dredging	Oct. 20, 1896		Aug. 15, 1897

O 10.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WRECK AND AN OLD RAFT OF LOGS IN DARIEN HARBOR, GEORGIA.

On April 9, 1897, the Secretary of War allotted $900 for the purpose of removing the wreck of a wooden vessel and a raft of logs at Brown John Shoal, Darien Harbor, Georgia. As far as they extended into the dredged channel, both were removed by the United States snag boat *Satilla* between the 1st and 10th of September, 1897. The cost of the work was $591.07, and the unexpended balance of $308.93 was returned to the Treasurer of the United States.

WRECK OF THE STEAMER R. L. MABEY IN BRUNSWICK HARBOR, GEORGIA.

The presence of this wreck was reported to me January 5, 1898. Its removal was authorized by Department letter of January 8, 1898, and $500 was allotted for this purpose from the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation. An additonal allotment of $500 was made by second indorsement, dated March 24, 1898.

The wreck was removed by W. M. Tupper & Co., of Brunswick, Ga., under their proposal, accepted March 25, 1898, to remove the same for $895. It was lifted bodily and placed in shallow water, entirely out of the channel. Work was begun March 28 and completed April 6, 1898.

The unexpended balance of $105 was returned to the Treasurer of the United States.

WRECK OF STEAMER ALLEN IN OCMULGEE RIVER, GEORGIA, JUST ABOVE THE MOUTH OF STONE CREEK.

The presence of this wreck was reported by me January 4, 1898. Its removal was authorized by Department letter January 10, 1898, and the sum of $500 was allotted for that purpose from the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation. The wreck was removed by the United States snag boat *Satilla*. It was broken up and entirely removed, the boiler and engines being taken out and deposited on the bank and afterwards turned over to the owner, Mr. W. A. Roush, who paid the cost of removing said machinery. This amount, $56.54, was deposited to the credit of the Treasurer of the United States.

Work was begun on January 17 and completed January 20, 1898. Its cost was $113.07. The unexpended balance of the allotment, amounting to $386.93, was returned to the Treasurer of the United States.

APPENDIX P.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN FLORIDA.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Cumberland Sound, Florida.
2. St. Johns River, Florida.
3. Volusia Bar, Florida.
4. Oclawaha River, Florida.
5. St. Augustine Harbor, Florida.
6. Indian River, Florida.
7. Caloosahatchee River, Florida.
8. Charlotte Harbor and Pease Creek, Florida.
9. Sarasota Bay, Florida.
10. Manatee River, Florida.
11. Withlacoochee River, Florida.
12. Suwanee River, Florida.
13. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEYS.

14. St. Johns River, Florida, at Orange Mills Flats.
15. St. Lucia Inlet and River, Florida.
16. Hillsboro Bay and River, Florida.
17. Anclote River, Florida.
18. Withlacoochee River, Florida.

United States Engineer Office,
St. Augustine, Fla., July 23, 1898.

General: I have the honor to submit herewith annual reports upon work of river and harbor improvement in my charge for the fiscal year ending June 30, 1898.

Very respectfully, your obedient servant,

W. H. H. Benyaurd,
Lieut. Col., Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

P 1.

IMPROVEMENT OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

[This work was in the charge of Capt. O. M. Carter, Corps of Engineers, to July 20, 1897, and of Capt Cassius E. Gillette, Corps of Engineers, from July 20 to December 6, 1897.]

For information relative to the original plan of improvement of this locality see page 792, Annual Report of the Chief of Engineers for 1879. A revised plan, submitted in 1891, is printed on pages 1565 et seq., Annual Report of Chief of Engineers for 1891. A second revision of the original plan of improvement, submitted June 12, 1895, and the report of a Board of Engineer Officers dated December 18, 1895, are printed on pages 1293 and 1289, respectively, Annual Report Chief of Engineers for 1896. This finally revised project was adopted by Congress by the river and harbor act of June 3, 1896.

The cost of the improvement was originally estimated at $2,071,023; as revised in 1891, at $2,079,500, and as revised in 1895, at $2,350,000, for completion.

In accordance with concurrent resolution No. 9, passed by the Senate May 26, 1897, and by the House of Representatives June 10, 1897, a special report upon the condition of the harbor of Cumberland Sound was submitted June 25, 1897, and is printed upon pages 1533 to 1535, Annual Report of the Chief of Engineers for 1897. This report recommended that dredging be commenced in accordance with the adopted project. The sum of $50,000 was appropriated for the purpose by the deficiency appropriation act approved July 19, 1897.

Work upon the jetties, under the contract of October 8, 1896, with the Atlantic Contracting Company, which was in progress at the beginning of the fiscal year, continued until October 9, 1897, on which date the contractor suspended work. No work has been done by the contractor since October 9, 1897. Operations extended over Range 3 of the north jetty and Range 9 of the south jetty.

North jetty.—Eight courses of brush mattresses, loaded with riprap stone, were carried from Station 19862.8 to Station 20412.4, a distance of 549.6 feet, the four lower courses being 100 feet wide and the four upper courses 80 feet wide. Eight courses of brush mattresses, loaded with riprap stone, were carried from Station 18275.4 to Station 19008.9, the lower four courses being 80 feet wide and the upper four courses being 70 feet wide. Four-course and one-course fascine mattresses 70 and 75 feet wide were carried from Station 19008.9 to Station 19621.3, also loaded with riprap stone. There were placed in this work 111,868.75 square yards of mattresses, 375.63 cubic yards third-class stone, and 7,616.93 cubic yards fourth-class stone.

South jetty.—There was no work done on the south jetty, excepting the placing of 1,361.81 cubic yards of fourth-class stone on mattresses previously sunk and for repairs to the jetty.

Altogether there was used on the entire jetty work during the fiscal year 111,868.75 square yards of mattresses, 375.63 cubic yards third-class stone, and 8,978.74 cubic yards fourth-class stone. These quantities and those above under the head of each jetty are not given as absolute, but are subject to deduction on account of some of the material and work not coming up to the requirements of the specifications forming part of the contract.

The estimated total amount of work to be done under the existing contract at time of letting was $2,141,250. At the end of this fiscal year the contractor had earned $604,685.21 (subject to deduction) and had been paid $345,000, leaving a balance due him of $259,685.21 (subject to deductions). No funds are available for making payment of amount due contractor. At least $300,000 should be made available at once and $450,000 additional before the end of the fiscal year ending June 30, 1899.

A survey of the jetties was made in October and November, 1897, and of the bar and sailing channel from March to May, 1898.

A project for the expenditure of the appropriation of $50,000 for dredging, made by act of July 19, 1897, was submitted and approved.

The U. S. dredge *Cape Fear*, belonging to the Cape Fear River improvement, was obtained for the work, and she commenced operations on August 16, 1897. She could not work between the jetties on account of the shallow depth, consequently no dredging has been done there. The sailing channel over the bar south of the south jetty having shoaled considerably, the work of the *Cape Fear* was confined to opening this channel for the relief of commerce. She removed 28,183 cubic yards of material between August 16 and September 24, 1897, on which latter date she stopped work and returned to the Wilmington, (N. C.) district.

An effort was also made at this time to deepen the cut through the south jetty on the line of the sailing channel. It was deemed impracticable to adapt the *Cape Fear* for this work, she being a suction dredge, while the material to be removed consisted of rock, logs, and brush, as well as sand.

Proposals for furnishing a clam-shell dredge for the work on the cut were invited September 29, 1897, and a plant was obtained from Rittenhouse R. Moore, with which operations were commenced on November 8 and continued until the end of that month. On account of protracted stormy weather the work was discontinued at this time. About 85 cubic yards of rock, 9 logs, and 7 binders were removed from the cut. The work was in an exposed locality, with very strong currents running over the site. It was much interfered with by rough weather, and altogether only eight working days could be secured, on only three of which full time could be worked. It was believed that a practicable depth of 15 feet at mean low water had been secured, but it was impracticable at that time to make an accurate examination.

No operations of any character were under way from November 30, 1897, to the middle of March, 1898, at which time a survey was commenced to determine extent of shoaling reported in sailing channel. The necessity for immediate dredging of this channel having arisen, by direction of the Secretary of War, work was commenced on March 25, 1898. The U. S. dredge *Cape Fear* was again secured for the work, and worked on the shoals in the sailing channel from March 25 to June 4, 1898, whenever the weather permitted. She removed a total of 59,128 cubic yards of material, which resulted in securing a channel 17 feet deep at mean low water through the bar and up to the south jetty crossing.

Efforts made in April, 1898, to secure a proper plant for deepening cut through south jetty to 17 feet not being successful, it was determined to fit the *Cape Fear* with rock grapples and endeavor to do the work with her. This was done, and after completing the dredging on the bar, on June 9th operations were commenced on the cut. By the end of June 44¾ cubic yards of rock and 14 logs had been removed from the jetty crossing.

The necessity for more rapid work being very urgent, further efforts to secure a powerful clam-shell dredge for this work were made, and on June 30 a plant was chartered to begin work at the earliest possible date. Shoaling on the bar was also reported as having again taken place at the end of the month, which will necessitate putting the *Cape Fear* back on that work in July.

An estimate of $450,000 is submitted as amount that can be profitably expended during the fiscal year ending June 30, 1900. This contemplates that the amounts necessary to pay the contractor for work done up to the end of this fiscal year, and for work that may be done during the fiscal year ending June 30, 1899, will be supplied when needed. It is estimated that the contractor will earn $400,000 during fiscal year 1900 and $50,000 additional will be needed for superintendence and contingencies.

The work is located in two collection districts, the north jetty being in the district of St. Mary's, Ga., and the south jetty in that of Fernandina, Fla. Amelia Light is the nearest lighthouse, and Fort Clinch, Fla., the nearest fort.

Money statement.

July 1, 1897, balance unexpended		$350,829.01
Amount appropriated by deficiency act approved July 19, 1897		50,000.00
Amount appropriated by sundry civil act approved July 1, 1898		450,000.00
		850,829.01
June 30, 1898, amount expended during fiscal year		362,924.51
July 1, 1898, balance unexpended		487,904.50
July 1, 1898, outstanding liabilities		261,437.87
July 1, 1898, amount covered by uncompleted contracts	*1,536,564.79	
July 1, 1898, balance available		226,466.63
Amount (estimated) required for completion of existing project		1,495,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		450,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

AMOUNT AND DATE OF ALL APPROPRIATIONS.

Under the original project for improving Cumberland Sound the following appropriations were made for the work:

June 14, 1880	$30,000	August 5, 1886	$112,500
March 3, 1881	100,000	August 11, 1888	112,500
August 2, 1882	50,000		
July 5, 1884	75,000	Total	480,000

Under the revised project of improvement the following appropriations were made:

September 19, 1890	$112,500
July 13, 1892	170,000
August 18, 1894	170,000
Total	452,500

Under the existing project of improvement the following appropriations have been made:

June 3, 1896	$5,000
June 4, 1897	350,000
July 19, 1897	50,000
July 1, 1898	450,000
Total	855,000

Contract in force.

Name and address of contractor.	Character of work.	Date of approval.	Work began.	Expires.
The Atlantic Contracting Co., John F. Gaynor, president, New York, N. Y.	Jetty	Oct. 8, 1896	Dec. 7, 1896	On or before the expiration of one year after the total sum of money for which the Secretary of War is authorized to enter into contract under these specifications shall have been appropriated.

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* This work is carried on under a continuing contract.

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---

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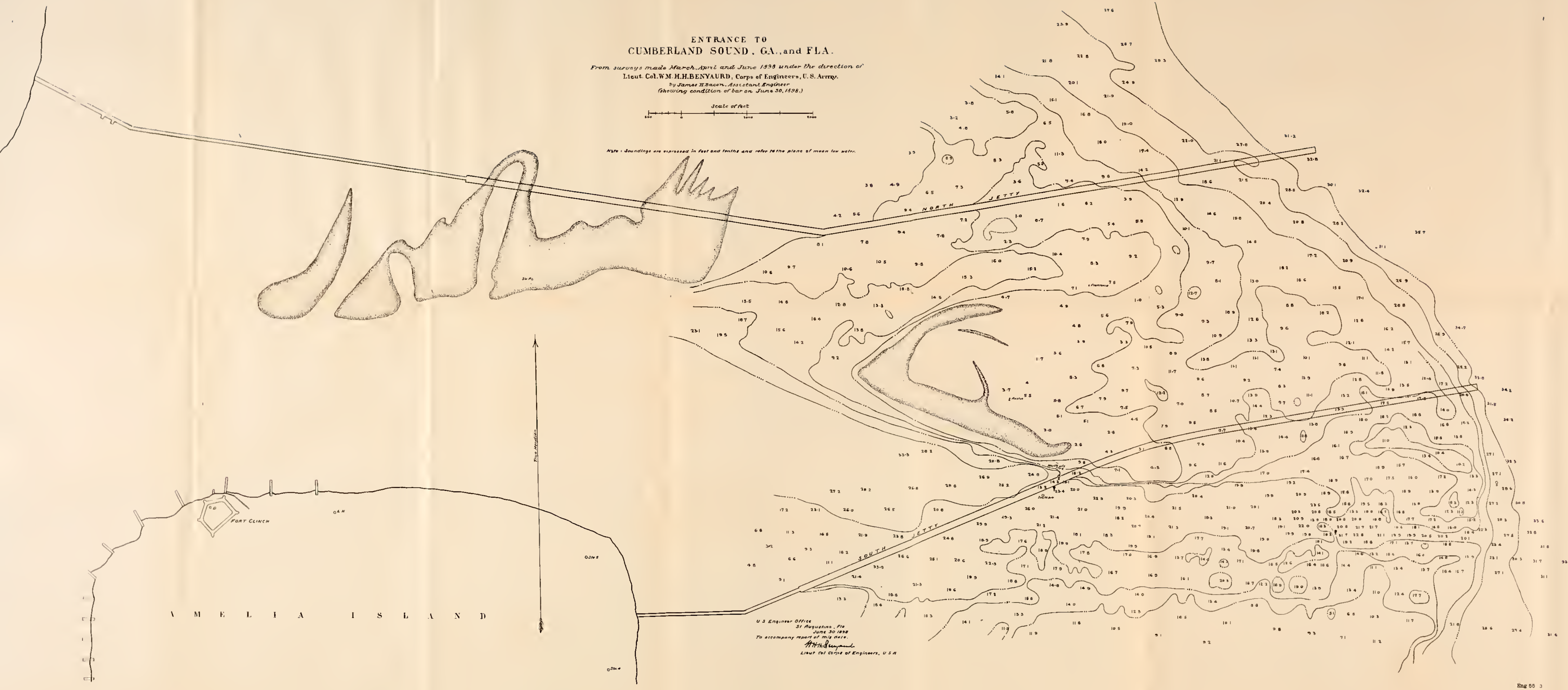
ENTRANCE TO
CUMBERLAND SOUND, GA., and FLA.

From surveys made March, April and June 1898 under the direction of
Lieut. Col. WM. H. H. BENYAURD, Corps of Engineers, U. S. Army.
by James H. Bacon, Assistant Engineer
(showing condition of bar on June 30, 1898.)

Note: Soundings are expressed in feet and tenths and refer to the plane of mean low water.



U S Engineer Office
St Augustine, Fla
June 30 1898
To accompany report of this date.
W H H Benyaurd
Lieut Col Corps of Engineers, U S A

Eng 88 3

COMMERCIAL STATISTICS.

Commerce of Fernandina, Fla., for the year ending December 31, 1897.

[Furnished by G. L. Baltzell, collector of customs.]

Articles.	Gross tonnage.	Estimated value.
Lumber	168,000	$1,027,232
Merchandise	10,400	5,200,000
Phosphate, rock	171,496	1,714,960
Total	349,896	7,942,192

Arrival and departure of vessels for the year ending December 31, 1897.

Kind of vessels.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	387	186,188	383	181,388
Sailing vessels	186	93,599	197	99,142
Total	573	279,787	580	280,530

Estimated number of passengers carried by water, 7,825.
Probable increase of trade were the improvement completed, 50 per cent.

P 2.

IMPROVEMENT OF ST. JOHNS RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the works accomplished, its cost, and the results obtained, attention is invited to pages 1305 to 1312, Report of the Chief of Engineers for 1896, and to pages 1586 to 1604, Report of the Chief of Engineers for 1895, the latter being a report upon a survey of St. Johns River, Florida, from Jacksonville to the ocean, with a view of securing a 24-foot channel.

It was decided to expend $150,000 of the sum of $200,000 appropriated in the river and harbor act of June 3, 1896, in raising the south jetty to the mean height of the water at the beginning of ebb flow from the present end of the concrete coping at Station 1260 to about Station 8000, and such other work upon the jetties at the mouth of the river as that amount would permit.

The contract with R. G. Ross, in force at the beginning of the fiscal year, was completed on November 25, 1897. During the fiscal year there were deposited on the jetties at the mouth of the river 23,214.18 tons of first-class and 7,486.37 tons of second-class stone. The total amount of stone placed upon the jetties under this contract is shown by the following table:

	First class.	Second class.
North jetty ... tons	10,464.71	7,083.08
South jetty ... do	34,666.52	616.65
Total ... do	45,131.23	7,699.73

This work resulted in building up the north jetty to the height of mean high water from Station 9450 to Station 10934, the present outer end of the jetty; and in building up the south jetty to the height of mean high water from the inshore end to Station 8200, and from there to Station 10712, the end of the jetty, to the height of mean low water.

A survey was made of the entrance in December, 1897, and another in June, 1898. A map of the latter is presented herewith. A comparison of the maps of these surveys with that of the survey made in June, 1897, shows that in December the channel across the bar had improved slightly since June, 1897, but during the period from December, 1897, to June, 1898, it has decidedly deteriorated. In December, 1897, a channel depth of 15 feet at mean low water was found, while in June, 1898, the depth was only 13 feet. This shoaling can be partly accounted for by the heavy breakers which are almost constant in the winter months both on the bar and on the shoals to the north.

The area included between the inner and outer 12-foot contours has been decidedly increased. There seems to be every indication that the sand deposited here is brought from the extensive shoals that exist both inside the jetties and to the north of them. No sand whatever crosses the south jetty or is brought around its outer end. The probability is that most of this deposit comes from the shoals to the north of the jetties, which are continually covered with breakers, and is brought around the end of the north jetty by the littoral currents. In any event the necessity of building up and prolonging the north jetty seems to be imperative. Nothing else would secure smooth water on the bar and no permanent improvement can be expected here until this is done.

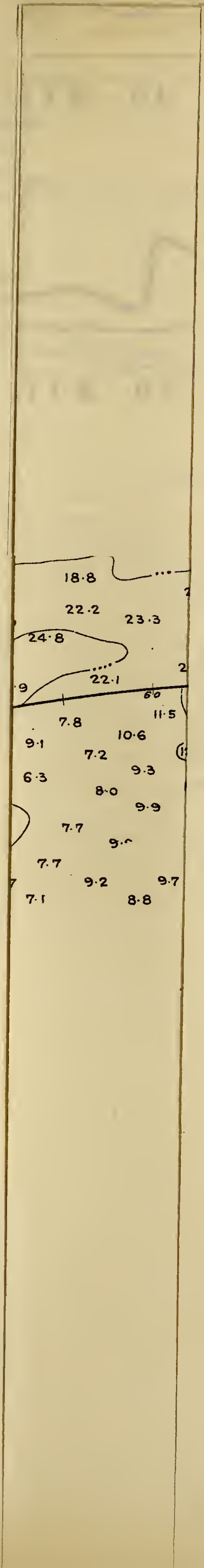
The south jetty, while it may be necessary eventually to extend it, is at present in such shape that little of the ebb flow passes over it. At the point where its crest drops from high water to low water the direction of the ebb flow is practically parallel to the jetty and it is not likely that any increase of height would produce a favorable result.

The channel inside the bar has not changed appreciably and no deterioration is found there. The beach on the south side of the entrance has been flattened considerably and in consequence the high-water line has receded. This action will be stopped by raising the north jetty.

For the reasons indicated above none of the $50,000 reserved from the funds appropriated by the act of June 3, 1896, has been expended for dredging on the bar.

In the river proper the conditions have not materially changed during the fiscal year. The shoaling at Mile Point has slowly continued until the available mean low-water depth is only 13.5 feet. This depth has been maintained, however, for some time and no further shoaling is apprehended. The mean low-water depths through the remaining cuts are the same as last year and are as follows: Cedar Creek Cut, 14 feet; Browns Creek Cut, 16 feet; St. Charles Creek Cut and Dames Point Cut, 18 feet. A depth of 18 feet was originally obtained at each of these cuts. The extensive shoaling in the two lower cuts at Mile Point and Cedar Creek has proved the necessity of dikes at these places. The present project contemplates building up and extending the submerged dike at Cedar Creek, but does not provide for a dike at Mile Point. It is probable, however, that a modification of the plans for the river dikes will permit the construction of the Mile Point dike without increasing the original estimate. Such a plan has been prepared and submitted.

The importance to commerce of securing a 24-foot channel from the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7·1
8·8

This work resulted in building up the north jetty to the height of mean high water from Station 9450 to Station 10934, the present outer end of the jetty; and in building up the south jetty to the height of mean high water from the inshore end to Station 8200, and from there to Station 10712, the end of the jetty, to the height of mean low water.

A survey was made of the entrance in December, 1897, and another in June, 1898. A map of the latter is presented herewith. A comparison of the maps of these surveys with that of the survey made in June, 1897, shows that in December the channel across the bar had improved slightly since June, 1897, but during the period from December, 1897, to June, 1898, it has decidedly deteriorated. In December, 1897, a channel depth of 15 feet at mean low water was found, while in June, 1898, the depth was only 13 feet. This shoaling can be partly accounted for by the heavy breakers which are almost constant in the winter months both on the bar and on the shoals to the north.

The area included between the inner and outer 12-foot contours has been decidedly increased. There seems to be every indication that the sand deposited here is brought from the extensive shoals that exist both inside the jetties and to the north of them. No sand whatever crosses the south jetty or is brought around its outer end. The probability is that most of this deposit comes from the shoals to the north of the jetties, which are continually covered with breakers, and is brought around the end of the north jetty by the littoral currents. In any event the necessity of building up and prolonging the north jetty seems to be imperative. Nothing else would secure smooth water on the bar and no permanent improvement can be expected here until this is done.

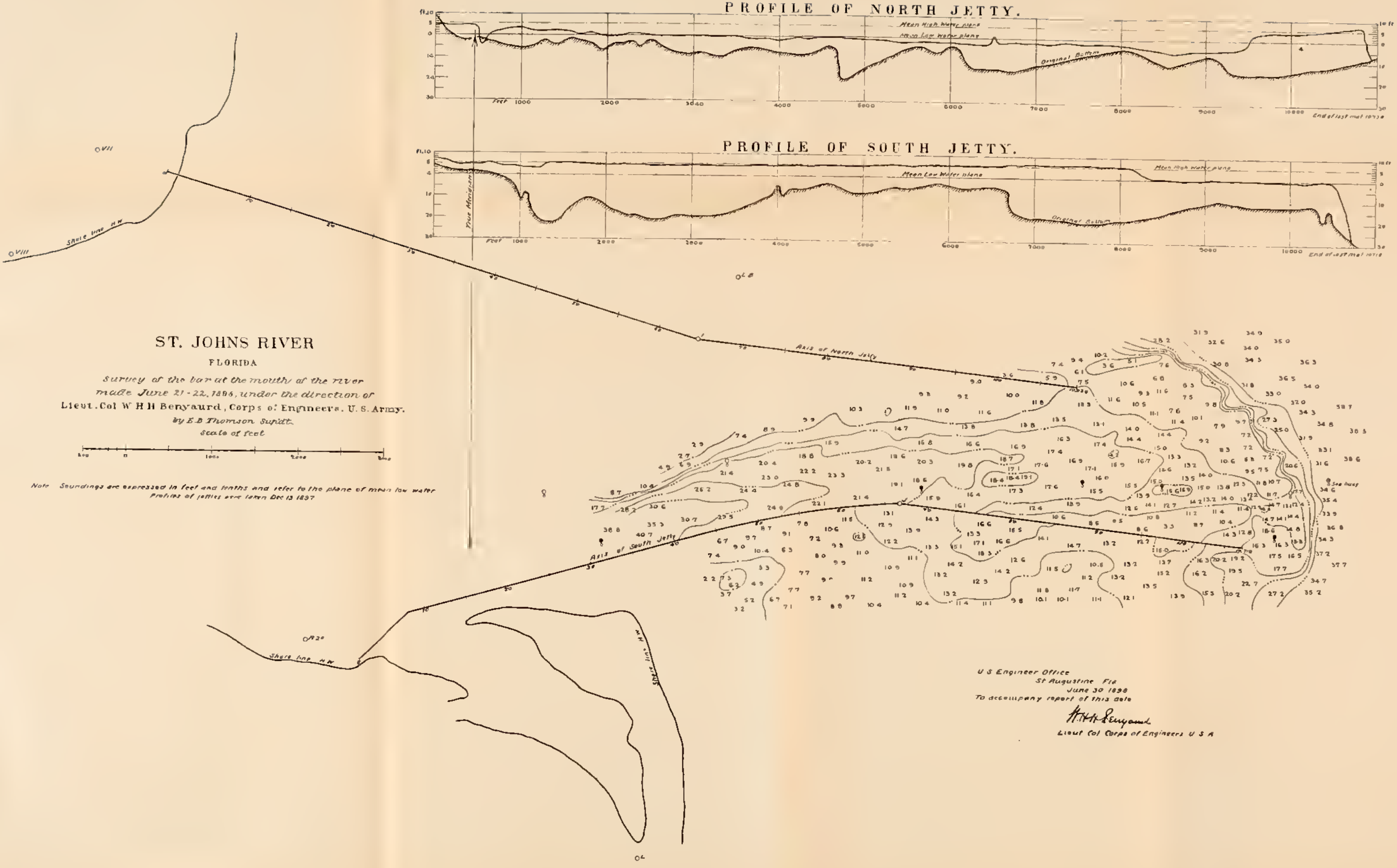
The south jetty, while it may be necessary eventually to extend it, is at present in such shape that little of the ebb flow passes over it. At the point where its crest drops from high water to low water the direction of the ebb flow is practically parallel to the jetty and it is not likely that any increase of height would produce a favorable result.

The channel inside the bar has not changed appreciably and no deterioration is found there. The beach on the south side of the entrance has been flattened considerably and in consequence the high-water line has receded. This action will be stopped by raising the north jetty.

For the reasons indicated above none of the $50,000 reserved from the funds appropriated by the act of June 3, 1896, has been expended for dredging on the bar.

In the river proper the conditions have not materially changed during the fiscal year. The shoaling at Mile Point has slowly continued until the available mean low-water depth is only 13.5 feet. This depth has been maintained, however, for some time and no further shoaling is apprehended. The mean low-water depths through the remaining cuts are the same as last year and are as follows: Cedar Creek Cut, 14 feet; Browns Creek Cut, 16 feet; St. Charles Creek Cut and Dames Point Cut, 18 feet. A depth of 18 feet was originally obtained at each of these cuts. The extensive shoaling in the two lower cuts at Mile Point and Cedar Creek has proved the necessity of dikes at these places. The present project contemplates building up and extending the submerged dike at Cedar Creek, but does not provide for a dike at Mile Point. It is probable, however, that a modification of the plans for the river dikes will permit the construction of the Mile Point dike without increasing the original estimate. Such a plan has been prepared and submitted.

The importance to commerce of securing a 24-foot channel from the



ST. JOHNS RIVER

FLORIDA

Survey of the bar at the mouth of the river
made June 21-22, 1898, under the direction of
Lieut. Col W H H Benyaurd, Corps of Engineers, U. S. Army.
by E B Thomson Supdt.
Scale of feet

Note Soundings are expressed in feet and tenths and refer to the plane of mean low water
Profiles of jetties were taken Dec 13 1897

U S Engineer Office
St Augustine Fla
June 30 1898
To accompany report of this date
W H H Benyaurd
Lieut Col Corps of Engineers U S A

ocean to Jacksonville can not well be overestimated, and the work should be vigorously carried to completion. In order to do this with economy the improvement should be conducted under the continuous contract system, and the sum of $500,000 could be profitably expended each year until completion.

Money statement.

July 1, 1897, balance unexpended	$164, 501. 58
June 30, 1898, amount expended during fiscal year	112, 593. 47
July 1, 1898, balance unexpended	51, 908. 11
July 1, 1898, outstanding liabilities	38. 75
July 1, 1898, balance available	51, 869. 36
Amount (estimated) required for completion of existing project	1, 909, 750. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	500, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improvement of St. Johns River, Florida.

June 14, 1880	$125, 000	September 19, 1890	$170, 000
March 3, 1881	100, 000	July 13, 1892	112, 500
August 2, 1882	150, 000	March 3, 1893	284, 500
July 5, 1884	150, 000	June 3, 1896	200, 000
August 5, 1886	150, 000		
August 11, 1888	175, 000	Total	1, 617, 000

Contract in force during the fiscal year.

Name of contractor.	Contract.	Date approved.	Date of beginning.	Date of expiration.
R. G. Ross	Jetty construction	Jan. 12, 1897	Feb. 1, 1897	Dec. 1, 1897

COMMERCIAL STATISTICS.

Commerce of St. Johns River, Florida, for year ending December 31, 1897.

[Furnished by Joseph E. Lee, collector of customs at Jacksonville, Fla.]

EXPORTS, FOREIGN AND DOMESTIC.

Articles.	Quantities.	Estimated value.
Lumber ... feet	116, 227, 367	$1, 862, 695
Shingles ... number	31, 741, 550	131, 000
Merchandise ... tons	4, 200	2, 348, 409
Cotton ... bales	1, 565	46, 950
Naval stores ... barrels	10, 000	30, 000
Vegetables ... crates	53, 900	107, 800
Cigars ... cases	651	162, 750
Fiber ... bales	480	7, 500
Oranges ... boxes	7, 900	19, 750
Fruits ... crates	8, 900	27, 700
Pig iron ... tons	300	7, 500
Hay ... do	27	446
Cattle	265	8, 000
Phosphate ... tons	406	2, 500
Total		4, 763, 000

Commerce of St. Johns River, Florida, for the year ending December 31, 1897—Continued.

IMPORTS, FOREIGN AND DOMESTIC.

Articles.		Quantities.	Estimated value.
Merchandise	tons	23,700	$3,364,010
Fertilizer	do	3,876	116,380
Steel rails	do	7,294	225,880
Coal	do	20,248	81,000
Hay	do	1,180	35,460
Tobacco	bales	748	66,330
Oil	barrels	59,228	296,140
Building stone	tons	40,380	100,950
Iron pipe	do	800	40,000
Total			4,326,150

Arrivals and departures of vessels for the year ending December 31, 1897.

Kind of vessels.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	193	366,523	192	367,099
Sailing vessels	270	95,418	253	89,998
Total	463	461,941	445	457,097

Estimated number of passengers carried by water	21,000
Estimated total trade of neighborhood carried by water, per cent	75
Probable increase of trade were improvement completed, per cent	100

P 3.

IMPROVEMENT OF VOLUSIA BAR, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to the Annual Report of the Chief of Engineers for 1897, page 1550, and for 1896, pages 1313 and 1314.

No work has been done during the fiscal year, no funds being available.

An appropriation of $2,000 is required each year to keep the bar in a navigable condition.

This work is in the collection district of St. Johns. Jacksonville is the nearest port of entry. Nearest light-house is Volusia Bar Light. Nearest fort is Fort Marion.

Money statement.

Amount that can be profitably expended in fiscal year ending June 30, 1900, for maintenance	$2,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improvement of Volusia Bar, Florida.

June 14, 1880	$5,000	September 19, 1890	$500
March 3, 1881	5,500	July 13, 1892	1,000
August 2, 1882	5,000	August 18, 1894	1,000
July 5, 1884	2,000	June 3, 1896	1,000
August 5, 1886	7,500	Total	29,000
August 11, 1888	500		

COMMERCIAL STATISTICS.

No data relating to the commerce passing Volusia Bar during the year ending December 31, 1897, could be obtained. Parties interested in the improvement were requested to furnish the information but did not respond.

P 4.

IMPROVEMENT OF OCKLAWAHA RIVER, FLORIDA.

For a description of the locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, see pages 1314 to 1316, Report of the Chief of Engineers for 1896.

There were no operations during the past fiscal year. It is proposed to expend the appropriation of $3,000, made in the act of June 3, 1896, in maintaining the improvement along that portion of the river already worked over, by the removal of such snags and overhanging trees as have become obstructions during the cessation of work.

A circular letter soliciting proposals for furnishing a plant with which to do the work was issued January 15, and bids were opened on January 29, 1898. The lowest bid, $51 per day, was considered too high, and on February 4 authority was granted to do the work with the U. S. snagboat *Suwanee* as soon as her services should become available. The war with Spain has thus far prevented bringing the *Suwanee* around from the west coast.

The sum of $15,000, still remaining unappropriated of the amount estimated to complete the existing project, in addition to $2,000 required for maintenance, could be profitably expended during the fiscal year ending June 30, 1900.

The Ocklawaha River is in the collection district of St. Johns. The nearest lighthouse is the St. Augustine Light. The nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1897, balance unexpended	$3,000.00
July 1, 1898, balance unexpended	3,000.00
Amount (estimated) required for completion of existing project	15,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900, including maintenance	17,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improvement of Ocklawaha River, Florida.

September 19, 1890	
July 13, 1892	$10,000
August 18, 1894	1,000
June 3, 1896	3,000
	3,000
Total	17,000

COMMERCIAL STATISTICS.

Commerce of Ocklawaha River, Florida, for the year ending December 31, 1897.

[Furnished by R. J. Adams.]

Articles.	Gross tonnage.
Cotton	1
Fertilizers	22
Fruits	3
Grain	260
Hides	2
Honey, sirup, etc.	18
Lumber	10
Merchandise	526
Vegetables	23
Hay	115
Naval stores	3,011
Total	3,991

Millions of feet of cypress lumber and cross-ties are taken out by different parties.

Arrivals and departures of vessels for the year ending December 31, 1897.

Kind of vessel.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	160	4,800	160	4,800

Estimated number of passengers carried by water	8,000
Estimated percentage of total trade of neighborhood carried by water, per cent	50

P 5.

IMPROVEMENT OF ST. AUGUSTINE HARBOR, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, see pages 1316 and 1317, Report of the Chief of Engineers for 1896.

The amount appropriated by the river and harbor act of August 17, 1894, being inadequate to construct the new work designed, is still held in reserve for emergencies that may arise as a result of storms. At present there is no erosion of the shore line.

There were no operations during the year ending June 30, 1898.

St. Augustine Harbor is in the collection district of St. Augustine, which is the nearest port of entry. Nearest fort is Fort Marion. The St. Augustine Light is the nearest light-house.

Money statement.

July 1, 1897, balance unexpended	$6,000.10
July 1, 1898, balance unexpended	6,000.10
Amount (estimated) required for completion of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	24,000.00

Appropriations for improvement of St. Augustine Harbor, Florida.

August 11, 1888	$35,000
September 19, 1890	20,000
July 13, 1892	10,000
August 18, 1894	6,000
Total	71,000

COMMERCIAL STATISTICS.

From information furnished by Thomas B. George, deputy collector of customs, there was no water commerce whatever at this port during the year ending December 31, 1897. One steamer of about 500 tons, which put in once and departed with a company of soldiers, comprised about all the arrivals and departures of vessels, with the exception of a few small pleasure boats.

P 6.

IMPROVEMENT OF INDIAN RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost and the results obtained, attention is invited to pages 1318 to 1320, Report of the Chief of Engineers for 1896, and to page 1554, Report of the Chief of Engineers for 1897.

No funds being available, there was no work done on the river proper between Goat Creek and Jupiter Inlet during the last fiscal year.

The river and harbor act of June 3, 1896, contained the following item:

> Improving Indian River, Florida, by dredging channel at Negro Cut, near Indian River Inlet, seven thousand five hundred dollars.

In submitting the estimate for this improvement the cost of the training wall to protect the dredged channel was included. It will be noticed that the item of the act quoted above provides for dredging only. The dredging having been completed, it is very desirable that some action be taken so that the balance available can be spent for the construction of the training wall. The Comptroller of the Treasury has decided that such an application of the available funds is not permissible without action of Congress.

The improvement of Indian River between Goat Creek and Jupiter Inlet is of sufficient importance to warrant that it be rapidly completed. The balance, $29,000, of the estimate for completing the project could be profitably expended during the fiscal year ending June 30, 1900.

The recommendation made in last Annual Report for the construction of a new combined dredge and snag boat, to replace the *Suwanee*, for use on this and other rivers and harbors in Florida, is again renewed. (See report on Manatee River.)

Money statements.

INDIAN RIVER BETWEEN GOAT CREEK AND JUPITER INLET.

Amount (estimated) required for completion of existing project	$29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	29,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

NEGRO CUT, INDIAN RIVER INLET.

July 1, 1897, balance unexpended	$9,399.49
July 30, 1898, amount expended during fiscal year	1,579.02
July 1, 1898, balance unexpended	7,820.47

Appropriations for improvement of Indian River, Florida.

July 13, 1892 (between Goat Creek and Jupiter Inlet)	$15,000
August 18, 1894 (Negro Cut)	5,000
March 2, 1895 (Negro Cut)	15,000
February 26, 1896 (Jupiter Inlet)	500
June 3, 1896 (Negro Cut)	7,500
Total	43,000

COMMERCIAL STATISTICS.

No commercial statistics for this river are given. Persons interested in the matter were requested to furnish them, but they have not done so.

P 7.

IMPROVEMENT OF CALOOSAHATCHEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to pages 1327 and 1328, Report of the Chief of Engineers for 1896.

The appropriation of June 3, 1896, has been applied during the fiscal year to maintenance. The work was done by the U. S. dredge *Suwanee*. Dredging was begun on the shoal near Beautiful Island on February 1, and finished February 12, 1898, during which time 6,291 cubic yards of material was removed from the channel. The *Suwanee* then proceeded up the river and began the removal of snags and overhanging trees. The work contemplated was finished on March 10, and resulted in removing 246 snags and 188 overhanging trees. Eleven channel marks were established in the lower river.

For recommendation for the construction of a new combined dredge and snag boat for use on this and other rivers and harbors in Florida see report on Manatee River.

An appropriation of $1,000 annually, or $2,000 biennially, will be required to keep the river in a fair navigable condition.

Caloosahatchee River is in the collection district of Key West, which is the nearest port of entry. The nearest light-house is Sanibel light, and the nearest fort is Fort Taylor, Florida.

Money statement.

July 1, 1897, balance unexpended	$1,707.75
June 30, 1898, amount expended during fiscal year	1,484.00
July 1, 1898, balance unexpended	223.75
Amount that can be profitably expended in fiscal year ending June 30, 1900, for maintenance Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	2,000.00

Appropriations for improvement of Caloosahatchee River, Florida.

August 2, 1882	$5,000	July 13, 1892	$1,000
July 5, 1884	5,000	August 18, 1894	2,000
August 5, 1886	4,000	June 3, 1896	1,000
August 11, 1888	10,000		
September 19, 1890	3,600	Total	31,600

COMMERCIAL STATISTICS.

Commerce of Caloosahatchee River, Florida, for the year ending December 31, 1897.

[Furnished by merchants, cattlemen, and fruit growers of Lee County, Florida.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cattle	35,500	Pineapples	250
Fertilizers	1,150	Vegetables	3,850
Fruits	275	Fish and oysters	120
Grain	1,750	Tobacco	2
Hides	300	Hay	225
Honey, sirup, etc	45	Lumber	3,450
Merchandise	21,500		
Oranges	1,375	Total	69,792

Arrivals and departures of vessels for the year ending December 31, 1897.

Kind of vessels.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	1,020	51,800	1,020	51,800
Sailing vessels	375	12,500	375	12,500
Total	1,395	64,300	1,395	64,300

Estimated number of passengers carried by water	16,000
Estimated total trade of neighborhood carried by water, per cent	95
Probable increase of trade were improvement completed, per cent	100

P 8.

IMPROVEMENT OF CHARLOTTE HARBOR AND PEASE CREEK, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to pages 1329 and 1330, Report of the Chief of Engineers for 1896, and page 1559, Report of the Chief of Engineers for 1897.

The appropriation of $20,000 made by the river and harbor act of June 3, 1896, has been expended in dredging. The contract with J. A. Bryan was extended on October 11, 1897, to December 15, 1897. The dredging operations were completed on December 14, and resulted in the formation of a channel 12 feet deep at mean low water from the wharves at Punta Gorda to the Gulf. This channel is 200 feet wide for the entire distance except in the cut near the wharves at Punta Gorda, where the width is 35 feet. This cut has been extended upstream a distance of 4,600 feet to the terminal wharf of the Plant Railway System.

During the fiscal year the contractor removed 43,427 cubic yards of material. Of this amount 32,678 cubic yards were taken from the cut leading to the wharf at Punta Gorda and 10,749 cubic yards from the cut at Cape Haze shoal.

It is estimated that $25,000 can be profitably expended upon this work during the fiscal year ending June 30, 1900.

Charlotte Harbor is in the collection district of Key West, and Punta Gorda is the nearest port of entry; nearest light-house is Gasparilla Light, and the nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1897, balance unexpended	$17,935.95
June 30, 1898, amount expended during fiscal year	17,483.17
July 1, 1898, balance unexpended	452.78
July 1, 1898, outstanding liabilities	10.00
July 1, 1898, balance available	442.78
Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	25,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improvement of Charlotte Harbor and Pease Creek, Florida.

September 19, 1890	$35,000
August 18, 1894	20,000
June 3, 1896	20,000
Total	75,000

Contract in force during the fiscal year.

Name of contractor.	Contract.	Date approved.	Date of beginning of work.	Date of expiration.
James A. Bryant	Dredging	Apr. 10, 1897	Apr. 15, 1897	Oct. 15, 1897

COMMERCIAL STATISTICS.

Commerce of Punta Gorda, Fla., for the year ending December 31, 1897.

[Furnished by A. W. Gilchrist.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cattle	1,000	Pineapples	400
Fertilizers	200	Phosphate, pebble	100,932
Grain	2,000	Vegetables	100
Hides	140	Fish and oysters	900
Lumber, rough	1,500	Hay	300
Lumber, dressed	1,500		
Merchandise	2,000	Total	112,172
Oranges	1,200		

Arrivals and departures of vessels for the year ending December 31, 1897.

Kind of vessels.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	21	25,974	22	26,211
Sailing vessels	56	33,639	59	37,628
Yachts	1	373		
Total	78	59,986	81	63,839

Estimated number of passengers carried by water	5,000
Estimated percentage of total trade of neighborhood carried by water, per cent	80

P 9.

IMPROVEMENT OF SARASOTA BAY, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to the Report of the Chief of Engineers for 1896, pages 1331 and 1332.

The act of Congress of June 3, 1896, appropriated $2,500 for improving Sarasota Bay from Tampa Bay to Caseys Pass, while the previous appropriations were applicable only as far as the town of Sarasota. The survey of 1889 was made, as directed, "From Tampa Bay to Caseys Pass," and an estimate was presented amounting to $37,500 for securing a channel 75 feet wide and 3 feet deep at mean low water through the shoals south of Sarasota. Under the act of 1896 the latter project is included so that the total estimate of cost is now $55,000.

During the fiscal year ending June 30, 1898, the following work has been done by the U. S. dredge *Suwanee:*

The cuts at Palma Sola Pass and at Long Bar have been widened to 50 feet, with a low-water depth of 6 feet.

A partial cut has been made into the shoal at the Mangroves 1,460 feet long, 30 feet wide, and 4 feet deep at mean low water. This has resulted in no benefit, as the rest of the shoal is bare in places at low water.

A total of 10,972 cubic yards of material were removed during the year.

The annual cost of maintaining the cuts already made will be about $1,000. That of maintaining the complete cuts will be about $2,500.

The amount required to complete the project is $42,500. The value to commerce of this improvement, when completed, will be commensurate with its cost as far as the town of Sarasota. From there to Caseys Pass its value is somewhat problematical, as this region is as yet only sparsely settled, although it is well adapted to the raising of fruits and vegetables, and is rarely visited by frost.

The construction of a new dredge and snag boat for use on this and other improvements in Florida is recommended to replace the *Suwanee.* (See report on Manatee River.)

Sarasota is in the collection district of Tampa, which is the nearest port of entry. Nearest light-house is Egmont Key Light. Nearest fort is Fort Taylor, Key West, Fla.

Money statement.

July 1, 1897, balance unexpended	$2,501.57
June 30, 1898, amount expended during fiscal year	1,930.03
July 1, 1898, balance unexpended	571.54
Amount (estimated) required for completion of existing project	42,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	42,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improvement of Sarasota Bay, Florida.

September 19, 1890	$5,000
July 13, 1892	2,500
August 18, 1894	2,500
June 3, 1896	2,500
Total	12,500

COMMERCIAL STATISTICS.

Commerce of Sarasota Bay, Florida, for the year ending December 31, 1897.

[Furnished by J. Hamilton Gillespie, Sarasota, Fla.]

Articles.	Tons.	Articles.	Tons.
Cattle	260	Merchandise	1, 150
Fertilizers	55	Oranges	120
Fruits	75	Ship stores	10
Grain	70	Vegetables	110
Hides	20	Fish and oysters	200
Honey, sirup, etc	20		
Lumber	550	Total	2, 640

Arrivals and departures of vessels for the year ending December 31, 1897.

Kind of vessels.	Arrivals.		Departures.	
	Number.	Tons.	Number.	Tons.
Steamers	75	2, 250	75	2, 250
Sailing vessels	100	2, 000	100	2, 000
Total	175	4, 250	175	4, 250

Estimated number of passengers carried by water	300
Estimated total trade of neighborhood carried by water, per cent	90
Probable increase of trade were improvement completed, per cent	200

P 10.

IMPROVEMENT OF MANATEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, the results obtained, attention is invited to pages 1332 and 1333, Report of the Chief of Engineers for 1896.

The act of Congress of June 3, 1896, which appropriated $4,000 for continuing the improvement, provided "that $3,000, or as much thereof as may be necessary, be used in dredging, deepening, and otherwise improving the navigation of the channel known as the Cut-off, extending from said Manatee River, on the north side thereof, and below the town of Palmetto, into Terraceia Bay." For a description of this locality, the requirements of commerce, and the project adopted, attention is invited to pages 1562 and 1563, Report of the Chief of Engineers for 1897.

The project for this improvement was submitted on June 17, 1897, and approved June 23, 1897.

During the fiscal year a channel has been made from the Manatee River through the Cut-off to Terraceia Bay 2,840 feet long, 50 feet wide, and 4.5 feet deep at mean low water, requiring the removal of 20,074 cubic yards of material. A temporary training wall 1,475 feet long was built on one side of this cut. Three channel marks were built in the Manatee River and two in Terraceia Bay.

This improvement has resulted in forming a channel which can be used by small light-draft boats. It is not wide enough for some of the steamers that ply regularly between Tampa and the Manatee River. As the bulk of the traffic in and out of Terraceia Bay and the Manatee River is carried by the steamers, the advantage of the channel between the two bodies of water is apparent. It is desirable that this channel should be completed as contemplated, and that the balance required, $17,000, be made available.

No extensive dredging was done in the Manatee River during the year, except connecting the channel in the river with the Terraceia Cut-off. The depth of water called for by the project has been obtained, except across the bar at the mouth of the river. To do this work in an economical manner the full amount of the balance of the estimate for completing the project, $29,000, should be made available before it is commenced.

During the past few years the value of property and the amount of commerce in this vicinity has greatly increased, owing to the fact that the severe cold of 1895 caused such slight injury to fruits and vegetables as compared with the damage resulting generally elsewhere throughout the State. It is now said to have become the largest shipping point for these products on the west coast of Florida.

As stated in the last annual report, the combined dredge and snag boat *Suwanee* has become old, and it will soon become necessary to replace it by another. Where only small appropriations are made available for each river, and the localities at which work can be done to advantage are widely separated, it has been proved that more good can be accomplished by such a plant operated by hired labor than by any other method. The necessity for the construction of a new boat is urgent, and the recommendation that an appropriation of $50,000 be asked for, to be expended in the construction of a new dredge and snag boat for the improvement of the rivers and harbors in Florida, is earnestly renewed.

Manatee River is in the collection district of Tampa. Tampa is the nearest port of entry. Nearest light-house is Egmont Key Light. Nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1897, balance unexpended	$3,832.81
June 30, 1898, amount expended during fiscal year	3,682.91
July 1, 1898, balance unexpended	149.90
Amount (estimated) required for completion of existing project	29,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	29,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improvement of Manatee River, Florida.

August 5, 1882	$12,000	August 18, 1894	$3,000
August 5, 1886	11,500	June 3, 1896	*4,000
August 11, 1888	5,000		
September 19, 1890	6,000	Total	47,000
July 13, 1892	6,000		

*Including $3,000 for Terraceia Cut-off.

COMMERCIAL STATISTICS.

Commerce of Manatee River, Florida, for year ending December 31, 1897.

[Compiled from information furnished by Plant Steamship Line.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Fruits, miscellaneous	1,200	Oranges	1,540
Grain	5,275	Vegetables	3,885
Hay	1,800		
Merchandise	10,100	Total	23,800

Arrivals and departures of vessels for the year ending December 31, 1897.

Kind of vessels.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	600	200,000	600	200,000

Estimated number of passengers carried by water	44,000
Estimated percentage of total trade of neighborhood carried by water, per cent	100
Probable increase of trade were improvement completed, per cent	50

P 11.

IMPROVEMENT OF WITHLACOOCHEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to pages 1334 and 1335, Report of the Chief of Engineers for 1896, and to House Ex. Doc. No. 158, Fifty-third Congress, third session, this latter being a report upon a preliminary examination authorized by Congress in the river and harbor act of August 17, 1894.

With an allotment from the appropriation for examinations and surveys in river and harbor act of June 3, 1896, a survey of the river was made during the months of March, April, and May, 1897, from the head of navigation to the mouth.

The adopted project for the improvement of this river is practically completed. The improvement has not resulted in any marked benefit to commerce, as the season when the river is open and that when it is necessary to ship the products of the region do not correspond. Large deposits of phosphate have been discovered since the project was formed. The only means of getting this product to the coast is furnished by the railroads, and the cost of this transportation amounts to about one-half the value of the phosphate on board ship. A new project with estimates has been submitted and was printed in House Ex. Doc. No. 199, Fifty-fifth Congress, second session. This project contemplates:

1. Building four locks and dams, having a lift of 7 feet each, at an estimated cost of $423,000. These would afford navigation for vessels drawing 5 feet at all seasons of the year.

2. The improvement of the channel at the mouth to a depth of 6 feet and a width of 100 feet, at an estimated cost of $120,000. This improvement would afford navigation at all times for vessels drawing

5 feet to a point 12 miles above the mouth. From this point a railroad about 15 miles long would reach the main body of phosphate deposits.

There seems to be no question that the railroad referred to would be built at once if the entrance to the river was improved. Hence the logical order in which the new improvement should be carried on is, first, to improve the channel at the mouth, and second, if the development of commerce as a result of this improvement would warrant it, the question of building the locks and dams could be considered.

At present, while the expense of improving the channel at the mouth would be justified, the expenditure that would be entailed by the construction of the locks and dams is not warranted by the needs of commerce.

The recommendation made in last Annual Report for the construction of a new combined dredge and snag boat to replace the *Suwanee* for use on this and other rivers and harbors in Florida is again renewed. (See report on Manatee River.)

Withlacoochee River is in the collection district of St. Marks. Cedar Keys is the nearest port of entry. Nearest light-house is Cedar Keys Light. Nearest fort is Fort Marion, Fla.

Money statement.

July 1, 1897, balance unexpended	$785.12
July 1, 1898, balance unexpended	785.12

Appropriations for the improvement of Withlacoochee River, Florida.

March 3, 1881	$7,500	September 19, 1890	$5,400
July 5, 1884	3,000	August 18, 1894	800
August 5, 1886	3,000		
August 31, 1888	5,000	Total	24,700

COMMERCIAL STATISTICS.

No statistics of the commerce of the Withlacoochee River, Florida, for the year ending December 31, 1897, are available.

Mr. John L. Inglis, captain of a steamer plying on this stream, states that there is no commerce of any importance out of the river at present, the bar at the mouth making it impracticable to pass in and out. He further states that were a channel made through this bar about 200,000 tons of phosphate rock alone would be shipped annually by water from points along the river.

P 12.

IMPROVEMENT OF SUWANEE RIVER, FLORIDA.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, attention is invited to pages 1335 and 1336, Report of the Chief of Engineers for 1896.

During the fiscal year channels have been made to a depth of 4 feet at low water through the shoals at Fort McComb, and at Lower Double Island. There was removed during the year 1,301 cubic yards of sand, 742 cubic yards of rock, 10 snags, and 8 overhanging trees. The work was done by the United States snag boat *Suwanee*, with a hired crew.

With future appropriations it is proposed to continue the work of improving the river in accordance with the approved project, using the United States snag boat *Suwanee*, with a hired crew. As stated in the report upon the improvement of Manatee River, the *Suwanee* is now old, and having been in almost constant service of a heavy character since its construction in 1889, it must soon be replaced by another. With the small appropriations made for the various improvements at widely separated localities it is impracticable to arrange to have the work done by contract, and a boat of this character is indispensable.

It is estimated that the sum of $15,158, required to complete the work, can be profitably expended in carrying out the project during the fiscal year ending June 30, 1900.

Suwanee River is in the collection district of St. Marks. Cedar Keys is the nearest port of entry. Nearest fort is Fort Marion. Nearest light house is Cedar Keys Light.

Money statement.

July 1, 1897, balance unexpended	$3,497.27
June 30, 1898, amount expended during fiscal year	3,413.13
July 1, 1898, balance unexpended	84.14
Amount (estimated) required for completion of existing project	15,158.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	15,158.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations for improvement of Suwanee River, Florida.

June 14, 1880	$5,000	September 19, 1890	$3,000
March 3, 1881	3,000	July 13, 1892	3,000
August 2, 1882	5,000	August 18, 1894	3,000
July 5, 1884	5,000	June 3, 1896	3,000
August 5, 1886	5,000		
August 11, 1888	15,000	Total	50,000

COMMERCIAL STATISTICS.

Commerce of Suwanee River, Florida, for the year ending December 31, 1897.

[Furnished by Horn & Gilbert, Branford, Fla.]

Articles.	Gross tonnage.	Articles.	Gross tonnage.
Cotton	260	Ship stores	12,000
Fertilizers	45	Tobacco	2
Grain	900	Hay	300
Hides	20	Cotton seed	775
Honey, sirup, etc	25	Empty barrels	200
Lumber, rough	12,000		
Merchandise	8,800	Total	35,327

Estimated number of passengers carried by water	3,000
Estimated total trade of neighborhood carried by water, per cent	90
Probable increase of trade were improvement completed, per cent	80

Three steamers make two round trips a week during the entire year.

P 13.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

WRECKS IN MAN OF WAR HARBOR, KEY WEST, FLA.

The work of removal of eight additional wrecks in Man of War Harbor, described on page 1566, Annual Report of the Chief of Engineers for 1897, under contract with Charles W. Johnston, dated May 11, 1897, which was commenced on June 21, 1897, was completed on July 31, 1897. The contract price was $6,750, and the expenses of supervision, etc., brought the total cost of removal of the additional wrecks up to $7,618.29.

Contract in force during fiscal year.

Name of contractor.	Date of approval.	Date of commencement.	Date of expiration.
Charles W. Johnston	May 28, 1897	June 10, 1897	Dec. 10, 1897

P 14.

REPORT UPON CONDITION OF ST. JOHNS RIVER, FLORIDA, AT ORANGE MILLS FLATS, BELOW PALATKA, WITH REFERENCE TO NAVIGATION FOR OCEAN-GOING CRAFT, TOGETHER WITH ESTIMATE OF THE COST OF IMPROVEMENT.

[Printed in House Doc. No. 523, Fifty-fifth Congress, second session.]

Office of the Chief of Engineers,
United States Army,
Washington, D. C., June 4, 1898.

Sir: I have the honor to return herewith concurrent resolution of Congress passed by the House of Representatives May 5, 1898, and concurred in by the Senate May 6, 1898, requesting the Secretary of War to—

> furnish Congress with information as to the condition of the St. Johns River in the State of Florida, at the point known as Orange Mills Flats, below the city of Palatka, as the river runs, with reference to navigation for ocean-going craft, and what sum of money will probably be required to put said river at that point in condition for navigation for coastwise craft such as usually enter the said river, and whether or not the expenditure necessary for said purpose will be justified by the traffic above said point.

In response to the reference of the resolution to this office attention is respectfully invited to the accompanying report of May 30, 1898, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, the officer having charge of the improvement of St. Johns River.

Colonel Benyaurd states that to improve the shoal at Orange Mills Flats alone for seagoing craft that would reach Jacksonville with intent of making Palatka would be useless unless the channel depths below be likewise improved, and he presents a project which contemplates a channel depth of 13 feet at mean low water.

He estimates the cost of a channel 200 feet wide and 13 feet deep at mean low water between Jacksonville and Palatka to be $120,000, and states that in his opinion the commercial interests of the St. Johns River warrant the improvement of the river over the stretch in question.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., May 30, 1898.

GENERAL: I have the honor to submit the following report, with recommendation, called for in your indorsement of May 12, 1898, upon the resolution of Congress regarding improvement of Orange Mills Flats, St. Johns River, Florida.

The examination of the river was made by Mr. J. H. Bacon, assistant engineer, who has long been connected with various surveys and improvements of the St. Johns River. His report, with commercial statistics, is appended.

Under date of February 23, 1895, a report was rendered by Maj. Thomas H. Handbury, Corps of Engineers, on a preliminary examination of "St. Johns River, Florida, at Orange Mills Flats, near Palatka, and for the improvement of the channel of the St. Johns to Sanford and points above." The report thereon will be found in Report of the Chief of Engineers for 1895, pages 1560 et seq. The proposed improvement contemplated a channel for seagoing vessels for a long stretch of river above Orange Grove Mills.

The cost of the improvement, as that contemplated by the provision of the act, appeared to be so out of proportion to the benefits that would be derived, an adverse report was rendered, which was concurred in by the division engineer and by the Chief of Engineers.

In the present instance the resolution calls for the information regarding the river at Orange Mills Flats, and what sum of money will be required to put the St. Johns River in a condition for such coastwise craft as usually enter the river, and whether the expenditure necessary for said purpose will be justified by the traffic above said point.

Orange Mills Flats is about 7 miles below the town of Palatka, which point is some 58 miles above Jacksonville. From Jacksonville to the mouth of the river the distance is about 25 miles. There is on the bar at the mouth of the river a depth of 15 feet at mean low water, and vessels drawing from 15 to 18 feet navigate the river easily to Jacksonville.

The examination made by Mr. Bacon developed the fact that the depth of water over Orange Mills Flats was but 10 feet. Further, that there were 23 miles of river below where the mean low-water channel depth is 15 feet or less, about 3 miles where it is 12 feet or less, and 1¼ miles where it is 10 feet or less. The 10-foot depth is at Orange Mills Flats, referred to in the resolution.

To improve this shoal alone for seagoing craft that would reach Jacksonville, with intent of making Palatka, would therefore appear a useless expenditure of money without the channel depth of the shoals below would be likewise improved. So, in considering the intent of the resolution, which appears to be to improve the river to Palatka, the cost of improving the lower reaches has been taken into consideration and an estimate is presented for a channel depth of 13 feet at mean low water. This depth, while not accommodating the deep-draft ships, will easily accommodate those that might be desired in the seagoing lumber business of the St. Johns.

In making the estimate, the improvement of certain shoal places enumerated in Mr. Bacon's report has been taken into consideration.

The estimated cost of a channel 200 feet wide with a mean low-water depth of 13 feet is placed at $120,000. This estimate is based upon other dredging work done in the St. Johns River.

In my opinion, the commercial interests of the St. Johns River warrant the improvement of the river over the stretch in question.

Very respectfully, your obedient servant,

W. H. H. Benyaurd,
Lieut. Col., Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

REPORT OF MR. JAMES H. BACON, ASSISTANT ENGINEER.

United States Engineer Office,
St. Augustine, Fla., May 25, 1898.

Colonel: I have the honor to submit the following report on a preliminary examination of Orange Mills Flats, in the St. Johns River, Florida, made on May 19, 1898:

This examination was made in response to a resolution by the House of Representatives on May 5, 1898, and agreed to by the Senate on May 6, 1898. This resolution requests the Secretary of War "to furnish Congress with information as to the condition of the St. Johns River in the State of Florida, at the point known as Orange Mills Flats, below the city of Palatka, as the river runs, with reference to navigation for ocean-going craft, and what sum of money will probably be required to put said river at that point in condition for navigation for coastwise craft such as usually enter the said river, and whether or not the expenditure necessary for said purpose will be justified by the traffic above said point."

The coastwise craft that usually enter the St. Johns River draw from 15 to 18 feet of water when loaded. The available depth at high water to Jacksonville is about 18 feet. The distance from Jacksonville to Palatka is 58 miles, and of this distance there are 23 miles where the mean low-water channel depth is 15 feet or less, about 3 miles where it is 12 feet or less, and 1¼ miles where it is 10 feet or less. This 10-foot shoal is called Orange Mills Flats, and is about 7 miles below Palatka. It is evident that if this shoal is alone deepened to the ruling depth below Jacksonville (and this consideration is called for by the resolution) there will be left about 22 miles of river below Palatka where such ocean-going craft could not navigate. Hence, in making this report I shall depart from the letter of resolution quoted and be guided by the spirit of it.

As mentioned above, there are about 23 miles of the river below Palatka where the available mean low-water depth is 15 feet or less, 3 miles where it is 12 feet or less, and 1¼ miles where it is 10 feet or less. To obtain a channel of 15 feet through 23 miles of river is manifestly out of the question, and I have made an estimate of the cost of making a channel 13 feet deep at mean low water (or about 14 feet at high water). In making this estimate it has been necessary to consider, in addition to the Orange Mills Flats, shoals at the following points below Palatka, viz, Forresters Point, Raceys Point, and Tocoi. From the data at hand it is probable that to obtain the 13-foot channel no dredging would be necessary except at the points named.

The average mean low-water depth on the Orange Mills Flats is about 10 feet, that on the other three shoals mentioned about 12 feet. The material to be removed from Orange Mills Flats is mud, and is probably the same at the other points.

In making the estimate a liberal allowance has been made for back filling and caving in on the sides. The estimate is necessarily a rough one, as the available data are meager. For a more accurate estimate a survey would be necessary, and this would cost about $2,500. The estimate is as follows: For a channel 200 feet wide and 13 feet deep at mean low water from Palatka to the ocean:

For dredging 500,000 cubic yards mud, at 20 cents	$100,000
For engineering and contingencies, about 15 per cent	20,000
Total	120,000
For maintenance, annually, about	1,000

I consider that the cost of this improvement would be justified by the needs of the case, for the following reasons: Palatka is the terminus of the Georgia Southern and Florida Railroad, which runs through a timber-producing country and annually brings to Palatka a large amount of lumber, which is shipped from there on coastwise vessels. A considerable portion of this lumber is lightered down the river at a cost of 75 cents per 1,000 feet B. M.

Besides the lumber brought in the railroad, there is a large amount sawed and shipped by the Palatka mills. In addition to the lumber interests, there is in Palatka a large sash, door, and blind factory, a pressed-brick factory, and a growing business in naval stores. Most of these enterprises have sprung up in the last three years, and would be greatly benefited by the improvement proposed. For the further details as to the business interests at Palatka, I respectfully refer you to the statement of the president of the Palatka Board of Trade, which is inclosed.

Very respectfully, your obedient servant,

JAMES H. BACON,
Assistant Engineer.

Lieut. Col. W. H. H. BENYAURD,
Corps of Engineers, U. S. A.

LETTER OF PRESIDENT OF PALATKA BOARD OF TRADE.

PALATKA BOARD OF TRADE,
Palatka, Fla., May 25, 1898.

DEAR SIR: I herewith submit for your consideration, in making your report under a late resolution of Congress, an account of lumber and shingles shipped from this point for the year ending October 1, 1897, and an estimate of amount that will be shipped for year ending October 1, 1898. I would also call your attention to the fact that Palatka is practically at the head of deep-water navigation on the St. Johns River. With the deepening of the river at what is known as "Orange Mills Flats" to a depth of 12½ to 13 feet it would enable vessels of deeper draft to reach Palatka. As it is now, our shippers have to seek light-draft vessels and lighter below the flats. This causes great delay in time and expense of 75 cents per thousand feet. And many vessels loaded by our mill men, owing to the fact that they can not load but a small quantity at the wharves here, refuse to charter only from Jacksonville, requiring the whole cargo to be lightered to Jacksonville. With the deepening of the river at the point named to 12½ or 13 feet there would be no trouble in securing charter direct to and from Palatka.

Palatka is also an important railroad center as a distributing point. It is the eastern terminus of the Florida Southern Railway, now part of the Plant system, extending from Palatka to Gainesville, Ocala, Leesburg, Brookville, Lakeland, Bartow, Punta Gorda, and Tampa; the Jacksonville, Tampa and Key West Railway, reaching Titusville and Sanford; the East Coast Railway, reaching all points on east coast; the Georgia Southern and Florida Railway, extending from Macon to Palatka, a distance of 286 miles, Palatka being its terminus. This road passes through a very fertile section of Florida and Georgia, which is capable of a high state of cultivation, and with increased deep-water facilities at Palatka this line of road would develop a rich agricultural country and build up a large commercial business. A large amount of virgin timber stands along the line of this road, which is only waiting for deep water at "Orange Mills Flats" to set the mills in operation. In our opinion there is no improvement costing so little money on any river in the South that would be of so much benefit as this contemplated improvement.

In addition to the immense lumber business developed and to be developed the naval-store business is assuming large proportions in the vicinity of Palatka and along the railroads named and along the St. Johns River and its tributaries. By this deepening of the river the phosphate field would be from 75 to 100 miles nearer deep water. The excellent position of Palatka as a distributing point is well shown by a report of W. A. Merryday, which I attach hereto. Other large dealers are located here handling a heavy class of goods, such as hay, grain, fertilizers, etc., that can be more economically handled by vessels. Should you have time before making your report, we would be pleased to have you visit Palatka—visit our mills and door and sash factory. Our people will be glad to meet you and give you all the information possible.

Yours, truly,

E. S. Crill,
President Board of Trade.

Lieut. Col. W. H. H. Benyaurd,
Corps of Engineers, U. S. A.

Shipped during year from October 1, 1896, to October 1, 1897.

	Cargoes.
Wilson Cypress Company:	
Lumber (9,668,000 feet)	38
Shingles (6,500,000)	6
W. J. Tilghman & Sons:	
Lumber	16
Shingles	21
Hodges & Godfrey:	
Lumber	8
Shingles	2
Georgia Southern and Florida Railway, year 1897, lumber (15,842,000 feet)	63
	154

In addition to this there are several small mills that are not embraced in this output. With deep water the Georgia Southern and Florida Railway would more than double their shipments.

Estimate for year 1898.

	Cargoes.
Wilson Cypress Company:	
Lumber (12,000,000 feet)	50
Shingles (9,000,000)	9
W. J. Tilghman & Sons	50
H. A. Hodges	18
Seldon Cypress Door Company	15
Georgia Southern and Florida Railway, lumber (24,000,000 feet)	100
	242

The Georgia Southern and Florida Railway for months of March and April have exceeded this estimate:

Shipped during—	Feet.
March	2, 210, 000
April	2, 669, 000

Their shipment would be greatly increased even now but for the war, which only more forcibly implies the great necessity for this improvement of Orange Mills Flats.

Tonnage report for the year ending December 31, 1894.

	Merchandise.	Fertilizer.
	Pounds.	*Pounds.*
January 1 to March 31, inclusive	3, 931, 500	3, 529, 000
April 1 to June 30, inclusive	2, 561, 300	3, 018, 000
July 1 to September 30, inclusive	1, 605, 500	1, 724, 650
October 1 to December 31, inclusive	3, 853, 400	3, 550, 100
Total	11, 951, 700	11, 821, 750

Being 11,891 tons 1,450 pounds.

This does not include merchandise and fertilizer sold in and adjacent to the city, but actually shipped out on the steamboat and railroad systems from Palatka.

LETTER OF MR. W. A. MERRYDAY.

PALATKA, FLA., *March 6, 1897.*

DEAR SIR: Replying to your inquiry regarding vessels consigned to us during the year 1894 (the year before the freeze), will say that the steamship *City of St. Augustine* entered 13 times, and I received the following schooners: *L. A. Lewis, Nettie Langdon, Mark Gray, Flora Morang, Varuna, C. H. Wolston, H. J. McCarthy, S. B. Hubbard.*

The registered tonnage of the steamship *City of St. Augustine* was, I think, about 400 tons, and carrying capacity 800 tons, but owing to the shallow water on Orange Mills Flats could only bring about 500 tons to Palatka. The schooners average registered tonnage about 250 to 280 tons; carrying capacity, 500 to 600 tons. They could not, however, bring up over the flats more than 300 to 350 tons. In addition to the above, we received through Savannah, Ga., and by Clyde Line Steamship Company some 1,500 tons, as light-draft schooners, at the time shipments were made, could not be had, and larger vessels would not charter, as they could not bring full cargoes without lightering on the flats.

Yours, truly,

W. A. MERRYDAY.

Mr. T. B. MERRILL, *City.*

P 15.

SURVEY OF ST. LUCIA INLET AND RIVER, FLORIDA.

[Printed in House Doc. No. 548, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., June 23, 1898.

SIR: I have the honor to submit the accompanying copy of report dated June 15, 1898, with map, by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, of the results of a survey of St. Lucia Inlet and River, Florida, made to comply with the provisions of the river and harbor act of June 3, 1896.

The St. Lucia River empties into the Indian River opposite St. Lucia Inlet, and at the town of Stuart, 7 miles from its mouth, it divides into two branches known as the Northwest Branch and South Branch. There is already an available channel depth of 11 feet at mean low water from the mouth to Stuart, with widths varying from 1,200 feet to 6,000 feet, and Colonel Benyaurd states that it will never be necessary to carry any improvement farther up the river than Stuart, where the Florida East Coast Railway crosses. He therefore suggests no improvement of the river.

St. Lucia Inlet is considered as extending from the mouth of the St. Lucia River to the ocean, and has through it an available channel depth of 6 feet at mean low water. The depth across the bar is between 6 and 7 feet, and that on the shoal between deep water inside the bar and deep water in the river is 6 feet. Colonel Benyaurd is of opinion that any improvement of the inlet should begin at the bar, and that the first work to be undertaken is the construction of a breakwater to intercept the waves approaching from the northeast, this work to be followed by dredging. The construction of this breakwater as far as the 18-foot contour will, it is estimated, cost $347,000, and if extended to the 24-foot contour its cost will be about $729,000.

The estimates for dredging proposed are based on propositions to secure a channel 300 feet wide on bar and 200 feet wide inside the inlet, with depths of 8 feet, 10 feet, and 12 feet at mean low water, and are as follows:

Channel 8 feet deep	$24,600
Channel 10 feet deep	230,600
Channel 12 feet deep	484,000

The annual cost of maintenance will be about $2,000 for dredging and $3,000 for repair of breakwater.

These estimates are made on the assumption that the entire amounts will be appropriated in one sum, and Colonel Benyaurd states as his opinion that the expenditure of a moderate sum on the improvement of the inlet seems to be justified, and that the improvement is worthy of being undertaken by the General Government.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., June 15, 1898.

GENERAL: I have the honor to submit the following report on the survey of St. Lucia Inlet and River, Florida, made in compliance with the provisions of the river and harbor act of June 3, 1896:

The report on the preliminary examination was submitted by Maj. Thomas H. Handbury December 15, 1894, and is printed in the Annual Report, Chief of Engineers, 1895, page 1564.

The survey was begun on January 5, 1898, and finished on February 28, 1898.

St. Lucia Inlet (called Prospect Inlet on the Coast Survey charts) is the result of an artificial opening made across a narrow strip of land that separated the lower end of Indian River from the ocean, at a point about 16 miles north of Jupiter Light and Inlet, and at latitude 27° 10′. The opening was made by the citizens of the vicinity at their own expense, and was originally 30 feet wide and 5 feet deep from mean low water mark. It is now 1,700 feet wide and has an available mean low-water depth of 6 to 7 feet. The location for this opening could not have been improved on. It is so situated that there is little or no danger of its being closed by natural causes—a danger that is to be apprehended at several inlets in the vicinity. An inlet existed at one time two or three miles south of St. Lucia Inlet, known as Gilberts Bar. This was gradually closed by natural causes, and there is now no trace of it. This inlet, however, opened into Jupiter Narrows, a very shallow and narrow waterway, and could not be expected to be permanent.

St. Lucia Inlet, on the other hand, opens into the Indian River where it is 2 miles wide and is directly opposite the mouth of the St. Lucia River. It is, in fact, the only inlet on the east coast of Florida south of the St. Johns River where the ebb discharge predominates over the flood discharge.

The St. Lucia River empties into the Indian River opposite St. Lucia Inlet. It is essentially a tidal stream for a distance of 12 miles from its mouth. It differs from the Indian River, which is more properly a lagoon, in that it receives a much larger amount of fresh water. The low swampy lands to the north and east of the Everglades are drained into the St. Lucia River. The opening of the inlet has reclaimed a large area of this land. Seven miles from its mouth, at the town of Stuart, the St. Lucia River is divided into two branches, known as the Northwest Branch and South Branch. The length of the former is 4½ miles and that of the latter is 3¼ miles. There is an available channel depth of 11 feet at mean low water from the mouth to Stuart, and the width varies from 1,200 feet to 6,000 feet. A large creek, locally known as Twelve Mile Creek, empties into the head of the Northwest Branch, and a similar creek, but shorter, into the South Branch. A reconnoissance of Twelve Mile Creek was made and plotted in the field, and the results show that the creek has a navigable channel of 10 feet at low water, with a least width of 100 feet for a distance of 15 miles. At this point it is formed by two small branches, both practically unnavigable.

The land in the vicinity of the St. Lucia River and its tributaries is well adapted to the growing of fruits and vegetables. There are numerous vegetable and pineapple gardens bordering on both the Indian and St. Lucia rivers. There is a line of steamers running regularly on the Indian River during the entire year, and on the St. Lucia River and Twelve Mile Creek during the vegetable and pineapple seasons.

I can suggest no improvement for the St. Lucia River for the present. It will never be necessary to carry any improvement farther up the river than Stuart, where the Florida East Coast Railway crosses it. The available depth to this point is now 11 feet at low water, and I can not conceive that a greater depth would be required for many years to come. In fact, should the necessity for more water arise, deep water could be carried to the railroad through Manatee Creek, which empties into the St. Lucia about 1 mile from the mouth of the river. The railroad crosses this creek 1¼ miles from its mouth, and the cost of a deep-water channel to this point would be greatly less than to Stuart.

The improvement of the St. Lucia Inlet to deep water in St. Lucia River can be regarded more favorably. A reference to the map, submitted with this report, will show that St. Lucia Inlet, which can be considered as extending from the mouth of the St. Lucia River to the ocean, has an available channel depth of 6 feet at mean low water. The depth across the bar is between 6 and 7 feet, and that on the shoal between deep water inside the bar and deep water in the river is 6 feet. There are, however, comparatively few days during the year when the passage across the bar is safe, even for vessels of very light draft, owing to the high seas that break entirely across it.

It is evident, then, that any improvement should begin at the bar. This is formed by a reef of coral rock covered in places by a thin layer of sand. The reef is the continuation of a rocky ledge that shows above high-water mark at a point about a mile above the inlet, and is bare of sand at the 18-foot contour and continues so to the 24-foot contour, where the sand is again found. From the 18-foot contour inshore it is covered with from 2 to 10 feet of sand.

The breakers prevailing on this bar are formed by winds ranging between northeast and northwest. The waves resulting from these winds approach the bar about on the course N. 70° E. These winds are prevalent during the winter and spring months, when navigation across the bar is most to be desired. The winds ranging between east and west from the south are comparatively light, and do not, as a rule, form breakers on the bar.

It seems evident that the first improvement to be undertaken here is the construction of a breakwater to intercept the waves approaching the bar from the northeast. The location of such a breakwater is shown on the map. For details as to its construction I invite attention to the report of Mr. James H. Bacon, assistant engineer, submitted herewith. Such a structure will keep the bar smooth, except during a gale from the south. As such an occurrence is rare, no provision is made for protection on the south.

The estimate of the cost of the breakwater as far as the 18-foot contour is $347,000, and to the 24-foot contour, $729,000, including 15 per cent for engineering and contingencies.

It is not expected that this breakwater will have any effect in deepening the channel across the bar. This must be done by dredging. But no dredging should be attempted until after the construction of the breakwater, for the reason that no dredge could work on the bar without the protection afforded by the breakwater. It is possible that, for the present depth, the breakwater would afford all the necessary protection if built only to the 18-foot contour. If however, any material increase of depth is desired it should be carried to the 24-foot contour.

Estimates for a channel 300 feet wide across the bar and 200 feet wide inside the inlet, for mean low-water depths of 8, 10, and 12 feet, have been made. These proposed channels extend from deep water outside the bar to deep water in the St. Lucia River, just beyond Sewalls Point. The cost of dredging sand on the bar is put at 30 cents per cubic yard, that of sand inside at 20 cents, and that of rock at $2.50. The tidal range at the inlet is 1.5 feet, and at Sewalls Point 1.2 feet.

The estimates for dredging are as follows:

Estimate No. 1.—For a channel 300 feet wide on the bar and 200 feet wide inside the inlet and 8 feet deep at mean low water.

33,000 cubic yards of sand, at 30 cents	$9, 900
55,000 cubic yards of sand, at 20 cents	11, 000
Engineering and contingencies, 15 per cent	3, 700
Total	24, 600

No rock excavation.

Estimate No. 2.—For a channel of the same widths as above and 10 feet deep at mean low water.

37,000 cubic yards of sand, at 30 cents	$11, 100
150,000 cubic yards of sand, at 20 cents	30, 000
62,000 cubic yards coral rock, at $2.50	155, 000
Engineering and contingencies, 15 per cent	34, 500
Total	230, 600

Estimate No. 3.—For a channel of same widths as above and 12 feet deep at mean low water.

38,000 cubic yards of sand, at 30 cents	$11, 400
250,000 cubic yards of sand, at 20 cents	50, 000
150,000 cubic yards coral rock, at $2.50	350, 000
Engineering and contingencies, 15 per cent	72, 600
Total	484, 000

The estimates for the breakwater and dredging are made on the assumption that the entire amounts will be appropriated at once.

The annual cost of maintenance will be about $2,000 for dredging and $3,000 for breakwater.

The expenditure of a moderate sum on the improvement of the St. Lucia Inlet seems to be justified for the following reasons:

1. The improvement would be practically permanent. The inlet is advantageously located to secure this result; the discharge is sufficient to maintain a depth of 12 feet at least, and the ebb discharge predominates over the flood.
2. The inlet is also in an advantageous location from a commercial point of view. Freight can be collected at all points on the Indian and St. Lucia rivers and their tributaries and carried by water through the inlet to its destination, and incoming freight can be distributed in the same way. The close proximity of the Florida East Coast Railway furnishes another argument in favor of the improvement.
3. It is the only opening into the Indian River worthy of improvement.
4. It will afford the only safe harbor of refuge for light-draft vessels between the Biscayne Bay and the St. Johns River.

I am of the opinion that the improvement is worthy of being undertaken by the General Government.

For further details I invite attention to Mr. Bacon's report and to the statement of Mr. H. E. Sewall, submitted herewith.

A map showing the entire St. Lucia River, St. Lucia Inlet, and a portion of the Indian River is also submitted.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN W. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. JAMES H. BACON, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., June 3, 1898.

COLONEL: I have the honor to submit the following report on the survey of the St. Lucia River and entrance:

Actual field work of the survey was begun January 5, and finished on February 28, 1898.

The St. Lucia River empties into the Indian River at latitude 27° 10′ and 16 statute miles north of Jupiter Inlet and Jupiter Light-house. From the Indian River to Stuart the St. Lucia River is from 1,200 to 6,000 feet in width, with an available low-water depth of 11 feet. Just above Stuart the river is divided into two branches, known as Northwest Branch and South Branch. The length of the Northwest Branch is 4½ miles and of the South Branch is 3¼ miles. From the junction of the branches to the mouth in the Indian River is 7 miles. The St. Lucia River, including both branches, is more properly an estuary. The water is always salt, and the range of tide at the head of the forks is little less than that at the mouth. The banks of the river are high and are frequently of a coral-rock formation.

The Florida East Coast Railway crosses the St. Lucia at Stuart, and passes close by the head of Manatee Creek, a distance of 2 miles from the mouth of the river. There are numerous pineapple plantations bordering on the river, and the land and climate seem to be peculiarly adapted to pineapple culture. There are numerous vegetable gardens on the east bank of the Indian River in this vicinity.

Emptying into the head of the Northwest Branch is a large creek, locally known as Twelve Mile Creek, and a similar creek, but shorter, empties into the South Branch. These creeks are sluggish streams, and drain the low-lying swamp lands to the northeast of the Everglades. There is a preceptible rise and fall of tide in both of these creeks throughout their entire length, although the water becomes fresh about 7 miles above their mouths. The land bordering on these creeks is very low and for the most part swampy. There are, however, especially on Twelve Mile Creek, numerous patches of rich hammock lands especially adapted to vegetable gardening.

There is a small settlement on Twelve Mile Creek, 15 miles from its mouth, known as White City. In this vicinity there are numerous vegetable gardens, and during the vegetable season, from January to April, a small steamer makes triweekly trips between Indian River and White City. Twelve Mile Creek is navigable, with a least depth of 10 feet and a least width of a 100 feet, for a distance of 15 miles. One mile farther up it divides into two branches, both practically unnavigable. The upper portion of this creek is somewhat obstructed by snags and overhanging trees, but the passage is made without difficulty by small steamers. A reconnaissance of this creek was made and mapped. At the time of the survey the water was about 1 foot above the low-water mark, and at the upper end about 6 feet below the high-water mark, which occurs in the spring and early summer. The South Branch Creek was examined from its mouth, where it is 200 feet wide for a distance of 7 miles, when it narrows to about 60 feet. This creek has the same general characteristics as Twelve Mile Creek. With the exception of one family there are no settlements on its banks.

ST. LUCIA INLET.

This inlet, called Prospect Inlet on the Coast Survey charts, but locally known as St. Lucia Inlet, was opened by the citizens in its vicinity in October, 1892. It was originally 30 feet wide and 5 feet deep, but is now 1,700 feet wide and the available depth at mean low water across the bar is from 6 to 7 feet.

The topography and hydrography in this vicinity have been changed a great deal since the inlet was opened, especially on the south side. An inspection of sheet No. 2 shows the character and extent of these changes, which may be summarized as follows:

1. The width of the inlet in 1894 was 1,000 feet; it is now 1,700 feet. The peninsula on the south, formed by the inlet, has entirely disappeared for a distance of 8,000 feet, and the land known as Long Island on the Coast Survey chart has been joined to the peninsula. The point of junction, however, is quite low and is awash during storm tides. The erosion, which amounts to about 130 acres, has been caused probably by the scouring action of the ebb tide in conjunction with the heavy seas which come in from the northeast. This erosion has now practically stopped, as the greater portion of the ebb tide passes out well to the northward of the south point of the opening. This is the only material change in the topography.

2. The hydrography in the lower end of Indian River has changed considerably. The shoals have become more shallow and have increased in area; the channel leading from Indian River to the inlet has deepened to a least depth of 6 feet at mean low water and has become wider.

3. The mean range of tide in the Indian River at a point about 1½ miles north of the inlet was determined by the Coast Survey in 1883 to be 0.16 foot. My observations at the same point show the mean range to be 0.60 foot. The mean range in the St. Lucia River has increased much more. A mean of 17 observations taken by the Coast Survey in 1883 at a point about a mile above Sewalls Point gives a range of 0.17 foot. The mean of my observations at Sewalls Point gives a range of 1.20 feet. The mean low water, from my observations at this point, is 0.20 foot higher than the mean low water obtained by the Coast Survey. My observations, however, were taken in January and February, while heavy winds from the north were prevailing. These winds blowing down the Indian River have a tendency to back up the water and to keep it at a higher level than usual. As the Coast Survey observations were taken in May and June, when the prevailing winds, being from the south, have an opposite tendency, the chances are the mean low water for the year has been lowered since the inlet was opened.

4. The tidal wave extends farther toward the head waters of the creeks emptying into the St. Lucia River, but the mean water level of these creeks has been lowered and the velocity of currents increased. As a consequence, some of the lands on the upper creeks which were formerly overflowed have been reclaimed and are now fit for cultivation.

5. Before the inlet was opened, the bottom of the Indian River, except in the narrow channel, was covered with a growth of eel grass, which extended nearly to the surface of the water. This grass has disappeared.

IMPROVEMENT OF THE ENTRANCE AND RIVER.

As the water in the St. Lucia River is deeper than that over the bar at the inlet, it is obvious that any improvement must begin at the bar. This bar is formed by a thin layer of sand over a reef of coral rock. The mean low-water depth on the bar at present is between 6 and 7 feet. The reef is bare of sand at about the 18-foot contour line, and continues so from there to about the 24-foot contour, where the sand is again encountered. From the 18-foot contour inshore the reef is covered by from 2 to 10 feet of sand.

At a point about 1 mile above the inlet the reef emerges from the water and attains a height of about 10 feet above low water. Toward the south it is found at varying depths until it joins the reefs bordering on the southern coast of Florida.

There are no outlying reefs or shoals of any kind outside of this bar to break up the waves before they reach it. Nearly all the high winds in the vicinity range between the northeast and the northwest, and the waves resulting from these winds approach and break on the bar about on the course N. 70° E. The waves caused by the northwest winds, although slower in formation, are equally as high and as dangerous as those caused by the northeast winds. During the eight weeks I spent in the vicinity there were not more than ten days on which a passage across the bar could have been made with safety.

The winds ranging between east and west are generally light, and the bar is comparatively smooth with the wind in a southerly quarter.

It seems evident, then, that the first improvement to be undertaken here is the construction of a breakwater to receive the brunt of the waves coming in from the northeast. The location of such a breakwater is shown on the maps. It leaves the beach at a point about 1,500 feet north of the inlet, and extends out on the course S. 56° E. A breakwater in this or a similar location, built up to 10 feet above low water on the outer end and to 5 feet above low water from there inshore, would afford a safe passage across the bar at all times, except during a gale from the southeast. As such a wind is extremely rare, I have made no estimate for any protection on the south. In my opinion the breakwater should extend out as far as the 24-foot contour line, but as it would be of great benefit if built only to the 18-foot contour, I present two estimates for breakwaters, extending, respectively, to the 18-foot and 24-foot contours. These estimates have been made on the following basis:

1. That the body of the breakwater should be formed of the coral rock abounding in the vicinity, built up to an apex at mean low water, with side slopes of 1 on 1½. One cubic yard of breakwater, including voids formed of this stone, is assumed to weigh 1 ton of 2,000 pounds.

2. That this structure should rest on a mattress 75 feet wide, ballasted with coral rock, for a distance of 700 feet, beginning at a point about 200 feet back from the low-water line; and from the end of the mattress to a point where the bare rock begins it should rest on a foundation of riprap or coral rock 75 feet wide and about 2 feet thick, laid directly on the sand. The distance would be about 3,100 feet.

3. That the coral rock should be covered with large stone, weighing 3 tons and over to the piece. This superstructure, 10 feet wide on top with side slopes of 1 on 1, is estimated for a height of 5 feet above low water for a distance of 2,800 feet from the low-water line on shore; from there to the end of the jetty it is estimated for a height of 10 feet above low water. In the computation this stone is assumed to weigh about 167 pounds per cubic foot, and 1 cubic yard of breakwater, including voids, is assumed to weigh 1½ tons of 2,000 pounds.

4. That there should be a shore extension similar to the breakwater running back about 700 feet from the low-water line inshore, and from the end of this extension a short groin, running out about 100 feet beyond the low-water line and crossing this line at right angles. This groin is considered necessary to prevent any possible swash channel making its way around the end of the shore extension. For details of construction see chart No. 2. The estimate for this breakwater is as follows:

ESTIMATES FOR BREAKWATERS.

Estimate No. 1.—For a breakwater extending to the 18-foot contour line.

Groin 450 feet long:	
Mattress, 3,700 square yards, at 75 cents	$2,775
Florida stone, 2,000 tons, at $2	4,000
Heavy stone, 1,500 tons, at $5	7,500
Total	14,275
Breakwater, including shore extension:	
Mattress, 6,000 square yards, at 75 cents	$4,500
Florida stone, 33,000 tons, at $2	66,000
Heavy stone, 42,000 tons, at $5	210,000
Total	280,500
Add cost of groin	14,275
Add cost of engineering and contingencies, 15 per cent	52,000
Total cost	346,775

Estimate No. 2.—For a breakwater extending to the 24-foot contour line and including groin and shore extension.

Mattress, 6,000 square yards, at 75 cents	$4,500
Florida stone, 73,000 tons, at $2	146,000
Heavy stone, 91,000 tons, at $5	455,000
Total for breakwater and shore extension	605,500
Add cost of groin, as above	14,275
Add cost of engineering and contingencies, 15 per cent	109,000
Total cost	728,775

DREDGING.

Estimates of the cost of dredging a channel 300 feet wide across the bar and 200 feet wide inside the inlet for mean low-water depths of 8 feet, 10 feet, and 12 feet have been made. The cost of dredging on the bar is estimated at 30 cents per cubic yard, and of that inside the inlet at 20 cents per cubic yard. The cost of rock excavation on the bar is estimated at $2.50 per cubic yard. There is no rock excavation for the depths named inside the inlet. These proposed channels extend from deep water outside the bar to deep water in the pocket in the St. Lucia River just beyond Sewalls Point. Estimates were also made for an anchoring ground 1,000 by 1,000 feet at the inner end of the deep hole just inside the inlet, but it was found that the cost of this anchorage would be about the same in each case as the cost of dredging a cut up to the Sewalls Point pocket. As this pocket affords a good harbor and is only 2 miles from the Florida East Coast Railway where it crosses the head of Manatee Creek, the question of anchorage near the inlet was not further considered.

The estimates for dredging are as follows:

Estimate No. 1.—For a channel 300 feet wide on the bar and 200 feet wide inside the inlet and 8 feet deep at mean low water.

33,000 cubic yards of sand, at 30 cents	$9,900
55,000 cubic yards of sand, at 20 cents	11,000
Engineering and contingencies, 15 per cent	3,700
Total	24,600

No rock excavation.

Estimate No. 2.—For a channel of the same widths as above and 10 feet deep at mean low water.

37,000 cubic yards of sand, at 30 cents	$11,100
150,000 cubic yards of sand, at 20 cents	30,000
62,000 cubic yards coral rock, at $2.50	155,000
Engineering and contingencies, 15 per cent	34,500
Total	230,600

Estimate No. 3.—For a channel of same widths as above and 12 feet deep at mean low water.

38,000 cubic yards sand, at 30 cents	$11,400
250,000 cubic yards sand, at 20 cents	50,000
150,000 cubic yards coral rock, at $2.50	350,000
Engineering and contingencies, 15 per cent	72,600
Total	484,000

It is recommended that no dredging be attempted until after the construction of the breakwater, for the following reasons:

1. No channel could be maintained across the bar without the protection of a breakwater, and also that it would be impracticable for a dredge to work on the bar in its present condition.

2. After the construction of the breakwater more complete information as to the depth of sand over the rock can be obtained. Owing to the almost continuous stormy weather during the progress of the survey this information is very slight. The amount of rock excavation, however, stated in the estimates, is probably somewhat greater than would actually be necessary.

Mr. H. E. Sewall, of Sewalls Point, in a letter, of which a copy is herewith submitted, states that the value of the crop in this vicinity for the last year amounted to $992,500, and of this sum $263,400 was paid to the transportation companies for freight; that two-thirds of this freight would have gone out of St. Lucia Inlet had it been navigable. No estimate is made of the cost of incoming freight, nor of the cost of exporting other commodities besides the crops; $400,000 would probably be a moderate estimate for the yearly freight charges paid by the people of this vicinity. If the inlet were made navigable for ships of 12 feet draft the people of the community would save from 15 to 20 per cent of the sum they now spend for freight, or at least $60,000 annually, and this would increase every year.

The estimates for a breakwater to the 24-foot contour line and a 12-foot channel combined amount to $1,213,000. Five per cent of this is $60,000. From an economic point of view, then, the improvement seems worthy of consideration. The probable annual cost of maintenance for this improvement would be about $2,000 for the dredged cuts and $3,000 for the breakwater.

It is probable, however, that the beach on the south side of the inlet may at some time require protection against erosion. As stated above, there is a low place on the peninsula between the ocean and Jupiter Narrows that is awash at very high tides. This, however, appears to be growing higher rather than lower, and I have not thought it necessary to make any provision for protection on this side of the inlet other than what the breakwater will afford.

In the early part of the present century there was an inlet into Jupiter Narrows known as "Gilberts Bar." This opening was 2 or 3 miles south of the present inlet, and was closed by natural causes many years ago; in fact, I can find no map showing it. There has been some apprehension that the St. Lucia Inlet might gradually close in the same way. There is little danger of this, I think, as the discharge through the St. Lucia Inlet, unless the physical characteristics of Jupiter Narrows have been altered to a very great extent, must be two or three times as much as formerly passed through the inlet at Gilberts Bar. A breakwater would insure the permanency of the opening.

The following data have been compiled:

Tides.

Mean range at the inlet	1.50
Mean range at house of refuge (Indian River	.60
Mean range at Sewalls Point (St. Lucia River)	1.20
Mean range at Stuart (St. Lucia River)	1

Currents at the inlet.

Maximum (mean) flood velocity per second	feet	3.28
Maximum (mean) ebb velocity per second	do	4.30
Mean time of ebb flow, about	hours	7
Mean time of flood flow, about	do	5

I submit with this report the following maps:

Map on scale of $\frac{1}{6000}$, showing area from mouth of St. Lucia River to deep water across the bar and a portion of Indian River—sheet No. 1.*

Map on scale of $\frac{1}{12000}$, showing St. Lucia Inlet and Bar, a portion of Indian River, and the entire St. Lucia River, including both forks—sheet No. 2.

Map on scale of $\frac{1}{6000}$, showing Twelve Mile Creek—sheet No. 3.*

I also submit two letters from Hon. H. E. Sewall, of Sewalls Point, giving commercial statistics.

Very respectfully, your obedient servant,

JAMES H. BACON,
Assistant Engineer.

Lieut. Col. W. H. H. BENYAURD,
Corps of Engineers, U. S. A.

STATEMENT BY HON. H. E. SEWALL.

SEWALLS POINT, FLA., *March 1, 1898.*

Santa Lucia Inlet was opened by the citizens in its immediate vicinity October 13, 1892, the citizens contributing the money for that purpose, which was $2,500. The inlet has proved a success up to the present time.

First. It has destroyed all the marlarious conditions existing in this region before its opening, making this one of the healthiest parts of Florida.

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* Omitted.

Second. It has been the means of draining, to a certain extent, back lands of the Santa Lucia country, thereby enabling them to be cultivated.

Third. It has proved a great benefit to small vessels and yachts, and is used by them continually passing in and out to sea.

Fourth. Being a landlocked harbor it has afforded a safe shelter for vessels from hurricanes and heavy storms.

WHY THE INLET SHOULD BE IMPROVED.

First. It being situated about halfway between Jacksonville and Key West, it taps the healthiest, most prosperous, and best agricultural part of the east coast of Florida.

Second. By deepening the inlet it would drain and bring into use thousands of acres of rich muck land which are now worthless. This grade of land is well adapted for the cultivation of rice, tobacco, and sugar cane.

Third. It would cheapen transportation on the exports and imports for this section. This would encourage immigration, also stimulate the farming and fruit-growing interests. By steamer direct to the North from this inlet the transportation rates on fruit and vegetables would be one-half less, with quicker dispatch, and no danger of freezing. It would also enable the people to bring in their provisions, hay, grain, lumber, coal, fertilizer, and ice for one-third less the cost which they now pay.

Exports from the east coast last year were—

Pineapples	$617,500
Vegetables	350,000
Oranges	25,000
	992,500

(Corrected by Indian River and Lake Worth Pineapple Association. Porcher, general agent.)

With direct water transportation this amount of exports will greatly increase annually. The improvement of the inlet will afford a safe and valuable harbor for small war vessels, such as torpedo boats and transports; also other vessels passing up and down the coast.

Respectfully submitted.

H. E. SEWALL.

JAMES H. BACON, Esq.

ADDITIONAL STATEMENT BY MR. SEWALL.

SEWALLS POINT, FLA., *March 9, 1898.*

DEAR SIR: Replying to yours of the 4th, will state that $992,500 is the amount the crop brought. A moderate estimate, and fixing as nearly as possible on an average rate of freight, I find that the transportation lines received for hauling these products $263,400. Two-thirds of this freight would have gone out of the Santa Lucia Inlet had it been deepened. During the year 1895 there was taken and shipped from the Santa Lucia and Indian rivers 2,573,318 pounds of fresh fish. (See United States Fish Commissioner's Report.) I am informed that one-fourth to one-third of these fish are sent to New York. The present rate of freight is 4 cents per pound.

JAMES H. BACON, Esq.,
Assistant Engineer.

P 16.

PLAN AND ESTIMATE FOR IMPROVING HILLSBORO BAY, FLORIDA, FROM ITS CONFLUENCE WITH TAMPA BAY, THROUGH HILLSBORO BAY AND RIVER, TO THE CITY OF TAMPA.

[Printed in House Doc. No. 545, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., June 15, 1898.

SIR: By the provisions of joint resolution of Congress approved May 7, 1898, the Secretary of War is authorized and directed to submit plans and estimates for the improvement of Hillsboro Bay, Florida, from its confluence with Tampa Bay, through Hillsboro Bay and River, to the city of Tampa, and he is requested to report to Congress whether or not it is advisable for the Government to undertake said improvement.

The duty of preparing the plan and estimates called for by the resolution was assigned to Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, the local officer at St. Augustine, Fla., and I have now the honor to present a copy of his report, dated June 3, 1898, with map, submitted under the instructions from this office.

The first appropriation made by Congress for work at this locality was contained in the river and harbor act approved June 14, 1880, and was for "improving Tampa Bay, Florida, deepening the bar and channel from the bar to the town of Tampa, ten thousand dollars." When this appropriation became available, two plans of improvement were considered, one providing for securing a straight channel from a point near the mouth of the river along the shortest distance to deep water in the bay, and the other contemplating deepening the present channel; but from motives of economy, and with a desire for early results, the money was applied to dredging the present channel, and an aggregate of $80,000 has been expended upon this work.

The plan now submitted contemplates securing a channel in Hillsboro River from a point about 100 feet south of the bridge crossing the river at Lafayette street to the mouth of the river, and from there along the line of shortest distance to the 12-foot contour in Hillsboro Bay; this channel to be 12 feet deep at mean low water, 200 feet wide in the river, and 150 feet wide in the bay. The work proposed is estimated to cost $300,000, with $1,000 annually for maintenance, and Colonel Benyaurd expresses the opinion that this expenditure is no greater than is commensurate with the interests involved.

I concur in his views.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., June 3, 1898.

GENERAL: In compliance with Department letter of May 17, 1898, I have the honor to submit the following report on the improvement of Hillsboro Bay, Florida:

Tampa Bay, 25 miles from the entrance, is divided into two arms. The easterly arm is known as Hillsboro Bay. This bay is about 10 miles long, north and south, and has an average width of 4½ miles. An available channel depth exists through Tampa Bay of 20 feet. At the confluence of Hillsboro Bay with Tampa Bay, and thence for a distance of 3 miles up Hillsboro Bay, the channel is obstructed by shoals having from 10 to 11 feet over them. A practicable channel way exists through these shoals having a least depth of 12½ feet at mean low water.

The 12-foot contour approaches the mouth of the Hillsboro River at, the city of Tampa to within a distance of 14,500 feet, measured on a straight line. By the line of the present channel the distance is 28,500 feet.

The available depth by the present channel into Tampa is 7 feet at mean low water. The channel is narrow and tortuous, and can only be navigated by very light-draft craft with the aid of numerous channel marks, which are difficult to maintain. Several examinations and surveys have been made with a view of improving this channel. The earliest undertaken by the Engineer Department, as far as our records show, was made in 1871. One, in more detail, was made in 1879, the report of which is contained in the Annual Report of the Chief of Engineers, 1879, pages 870 to 873. The available channel depth was then found to be 5½ feet at mean low water. A ledge of rock extending across the channel in the mouth of the river had only 7 feet of water over it.

An appropriation of $10,000 was made in the act of June 14, 1880. From motives of economy and the desire of early results, combined with what, at that time, was thought to be the best solution of the problem from an engineering standpoint, the money was expended in deepening the present channel. A straight channel from a point near the mouth of the river along the shortest distance to deep water was considered, but at the time it was thought that such a channel would be difficult to maintain. Experience since then, however, shows that straight channels through similar material and under like conditions, with the dredged material judiciously deposited along the sides, can be maintained at very little additional expense.

While on the other hand, with small appropriations and without the aid of training walls and deflecting dikes, a continuously curved channel, such as the one under discussion, where a depth throughout of 12 feet is desired, can not be secured, much less maintained. Current observations taken by Mr. J. W. Sackett, assistant engineer, at this place in 1887 show that, throughout portions of the channel at least, the current at no time flows in the direction of the channel either on the ebb or on the flood; neither does it continue in one direction throughout the duration of either tide. An aggregate of $80,000 has been expended upon this channel. A depth of 9 feet over a width of 200 feet has been secured in the river, where mostly rock excavation was required, but in the channel below there are places where it is less than 80 feet in width and the available depth is only 7 feet.

With the extension of the South Florida Railway across the peninsula separating Hillsboro Bay from Old Tampa Bay, in 1888, the necessity for continuing the improvement in Hillsboro Bay began to be less apparent. The channel leading into Old Tampa Bay was improved so that vessels drawing 20 feet could come to the wharf at Port Tampa, the terminus of the railroad. It was then thought that this would satisfy the demands of commerce. The fact remains, however, that the terminus is in the hands of one railway corporation with no competition, and the additional transfer entailed of merchandise received at Tampa is an item of considerable expense.

During the last fifteen years Tampa has grown from a mere village to a city of a population of 25,000. Most of this growth has been during the last two years.

There is one regular line of steamers plying between Tampa and New York. These vessels find it necessary to lighter a part of their cargoes to enable them to reach the wharves at Tampa. There is an average range of tide at Tampa of 2.2 feet.

The numerous surveys made by the Engineer Department are in sufficient detail to enable an estimate of the cost of a channel that would answer the demands of commerce to be prepared, with the possible exception of the amount of rock that would require removal from that portion of the river above the mouth and above where work has heretofore been necessary in the execution of previous projects. Sufficient soundings to rock have been taken to make a fair approximation of the amount that would require removal. If greater accuracy is required, an additional survey would be necessary. It is estimated that such a survey would cost $1,500.

On December 14, 1896, additional investigations were made as to whether rock would be encountered along the line of a straight channel direct from the mouth of the river to deep water in Hillsboro Bay. Twenty-five soundings, approximately equidistant, were taken with an iron rod. A depth was reached varying from 12 to 20 feet, depending upon the character of the material. In none of these soundings was rock encountered. The material was found to be mostly a mixture of sand and mud. In a few instances hard sand was found, and at one sounding taken at a point 300 feet south of the east point of Depot Key, in a depth of one-half foot of water, what appeared to be stiff clay was found at a depth of 9 feet, which could be penetrated with a rod to a depth of 12 feet. With this exception depths varying from 13 to 20 feet were reached.

It is believed that a permanent deeper and wider channel can be secured at this place with no greater expenditure than is commensurate with the interests involved.

The estimate for this channel is as follows:

25,000 cubic yards rock, at $3	$75,000
925,000 cubic yards sand, etc., at 20 cents	185,000
Engineering and contingencies, about 15 per cent	40,000
Total	300,000
For maintenance, annually	1,000

This estimate is for a channel in Hillsboro River, from a point about 100 feet south of the bridge, crossing the river at Lafayette street, to the mouth of the river, and from there along the line of shortest distance to the 12-foot contour in Hillsboro Bay. This channel is to be 12 feet deep at mean low water, 200 feet wide in the river and 150 feet wide in the bay. A training wall is to be formed of the dredged material on one side of the cut and about 50 feet from the edge. The quantities are estimated for a depth of 13 feet and an allowance for side slopes of one on three is made. The rock is limestone and mostly very soft.

In my opinion, Hillsboro Bay, from its confluence with Tampa Bay, through Hillsboro Bay and River to the city of Tampa, is worthy of improvement by the General Government.

I send herewith a tracing showing the location of the proposed cut.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S A.

P 17.

SURVEY OF ANCLOTE RIVER, FLORIDA.

[Printed in House Doc. No. 200, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 4, 1898.

SIR: I have the honor to submit the accompanying report of December 27, 1897, with map,* by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, of results of survey of Anclote River, Florida, made to comply with provisions of the river and harbor act of June 3, 1896.

The project presented by Colonel Benyaurd contemplates securing a channel 100 feet wide and 6 feet deep at mean low water from Anclote Anchorage to Sponge Harbor, and thence 4 feet deep at mean low water to the county bridge at Tarpon Springs. The cost, he estimates, will be $51,500, and he expresses the opinion that the improvement is well worthy of being undertaken.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., December 27, 1897.

GENERAL: I have the honor to present the following report on a survey of Anclote River, Florida, made in compliance with the river and harbor act of June 3, 1896:

The preliminary examination of the river was made in October, 1894, and the report thereon will be found in the report of the Chief of Engineers, United States Army, for 1895, page 1574. This preliminary examination developed the fact that the improvement of the river would be of great value to the sponge industry, which, although in a thriving condition, is greatly hampered by the obstructed condition of the river.

The river has a total length of about 20 miles, and is a small stream until it reaches a point about 3 miles from the mouth, where it receives the water flowing from a large spring called Tarpon Springs, situated at the head of Tarpon Bayou, through which it flows into the Anclote River. The thriving town of Tarpon Springs is located about the head of the bayou and between it and the river. The river below Tarpon Springs is badly obstructed by sand shoals and oyster bars, through which the channel pursues a narrow and tortuous way, with a depth varying from 2 to 14 feet at mean low water.

Nineteen vessels from Tarpon Springs are engaged in gathering sponges from the sponge bars located off the Gulf coast of Florida, mostly northward from the Anclote River. These vessels, together with about 100 hailing from Key West, bring their sponges to the mouth of Anclote River to be prepared for market and sold. With the river in its present condition, most of these vessels are unable to get into the river at all, and the transfer of sponges and supplies for the boats is carried on under considerable difficulty. The principal reason that this place is made the rendezvous for sponging vessels is on account of the excellent harbor just off the mouth of the river, known as Anclote Anchorage, which is protected from the Gulf of Mexico by the islands known as Anclote Keys and the outlying shoals.

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*Not reprinted. Printed in House Doc. No. 200, Fifty-fifth Congress, second session.

It is believed that a channel 100 feet wide and 6 feet deep at mean low water from Anclote Anchorage to Sponge Harbor, about 1¼ miles above the mouth of the river, and 4 feet deep at mean low water from Sponge Harbor to the county bridge at Tarpon Springs, would answer the present needs of the commerce of the river.

The following is the estimate of cost of such a channel, based upon the results of the survey made in May and June, 1897, by the field party in local charge of Mr. O. N. Bie, whose report is appended:

175,000 cubic yards dredging, at 25 cents	$43,750
Engineering and contingencies, about 15 per cent of total cost	7,750
Total	51,500

This improvement, in my opinion, is well worthy of being undertaken, and is earnestly recommended.

The map of the survey is respectfully submitted herewith.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. O. N. BIE.

UNITED STATES DREDGE SUWANEE,
Tampa, Fla., July 14, 1897.

COLONEL: I have the honor to submit my report on survey of Anclote River, Florida:

From Maj. Thomas H. Handbury's report to the Chief of Engineers, United States Army, on the preliminary examination of this river, dated December 21, 1894, I would respectfully quote:

"Anclote River is on the west coast of Florida, has its source in the swamps about 20 miles inland, and empties into the Gulf of Mexico about 35 miles to the northward of the entrance to Tampa Bay. At a point 2½ miles from its mouth a branch known as Tarpon Bayou comes in from the south. This is about 1 mile in length and 500 feet wide. Between this bayou and the river is situated the town of Tarpon Springs, a thriving place of about 700 inhabitants, which number is very much increased during the winter season. The place is on the line of the Sanford and St. Petersburg Railroad."

The improvement contemplated is an available channel with a mean low-water depth of 6 feet from the Anclote Anchorage outside of the bar to the town of Tarpon Springs.

Assisted by a transitman, recorder, and crew of the U. S. snag boat *Suwanee*, I began the survey May 25, 1897, and completed the fieldwork June 1, 1897.

A line 2,999.5 feet was measured on the north side of the river near its mouth, and, with this as a base, a series of triangles was extended from the mouth of the river to Anclote. From this point to the upper end of our survey (about 1,300 feet above the county bridge) the shore line was located by stadia and transit; soundings from the bar to the county bridge were located by two transits, and reduced to mean low water at Anclote, as determined from gauge readings extending over a period of eight days. The mean rise and fall of tide is 2.7 feet.

From the bar to station "Bulkhead," near the mouth of the river, is a tortuous but well-defined channel, having a mean low-water depth of 6 feet and over, except at its outer end and near stakes Nos. 2, 4, and 5. From station "Bulkhead" to Sponge Harbor the channel is very narrow and crooked, varying in depth from 3 to 6 feet, and is of little practical use except for small launches and sailboats. From Sponge Harbor to Tarpon Springs the river is badly obstructed by sand and shell bars, extending from either side of the river and overlapping, so there is no practical channel, though it is possible for a person thoroughly conversant with the shoals to bring a 2½-foot draft up to the town.

At Anclote, on the north side of the river and 2 miles inside the bar, and at Sponge Harbor, on the opposite shore, are large warehouses, where nearly all of the sponges are clipped and baled for shipment. As there is insufficient water in the river to bring the sponging vessels to these points, the fleet anchors about 1 mile north of the river at Bailey Point and discharges its cargo by the use of rowboats into large kraals near the shore. From this point the sponges are towed in lighters to the above-mentioned warehouses, which, necessarily, is a slow and expensive arrangement.

The improvement at present required for the benefit of commerce is, in my judgment, an available channel at least 100 feet wide and 6 feet deep from the bar to Anclote. To obtain this the line of the present natural channel could be followed as far as station "Bulkhead." From this point to Anclote it should be dredged on an almost straight line.

The following estimates, based on the results of our survey, have been made:

For a channel 100 feet wide and 6 feet deep from the bar to the county bridge on the east side of Tarpon Springs—

285,000 cubic yards sand and shell, at 25 cents per yard	$71,250
Engineering and contingencies	10,250
Total	81,500

For a similar channel from the bar to Anclote—

106,000 cubic yards sand and shell, at 25 cents per yard	26,500
Engineering and contingencies	4,000
Total	30,500

The depth is computed to 7 feet, allowing 1 foot for back fill, as customary.

Borings were taken along the river from Tarpon Springs to the bar and no rock found at a less depth than 9 feet. Some loose bowlders were found at a 9-foot depth, but in every instance a boring taken a few feet away would go below that depth.

Nineteen vessels from Tarpon Springs and 100 from Key West bring their sponges to Anclote for shipment. Total value of sponges sold at Tarpon Springs for the twelve months ending May 31 is $64,004.66.

A map* on a scale of $\frac{1}{5000}$, partly completed, and a plotting sheet showing the proposed lines of dredging, are submitted herewith.

I am indebted to Capt. Samuel E. Hope, deputy collector of customs at Anclote, for information furnished in regard to the commerce of this port.

Very respectfully, your obedient servant,

O. N. Bie.

Lieut. Col. W. H. H. Benyaurd,
Corps of Engineers, U. S. A.

P 18.

SURVEY OF WITHLACOOCHEE RIVER, FLORIDA, FROM ITS MOUTH TO THE HEAD OF NAVIGATION.

[Printed in House Doc. No. 199, Fifty-fifth Congress, second session.]

Office of the Chief of Engineers,
United States Army,
Washington, D. C., January 4, 1898.

Sir: The river and harbor act of August 18, 1894, contained an appropriation of $800 for Withlacoochee River, to be applied to maintenance, including a survey of the mouth of the river. In the Report of the Chief of Engineers for 1895 he states in regard to this item:

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* Only one map printed.

> This amount, being entirely inadequate to defray the expenses of a survey which is assumed to have for its object the collection of data on which to base an estimate of the cost of improving the mouth of the river, has not yet been expended.

The next river and harbor act passed by Congress (act of June 3, 1896) provided for a survey of "Withlacoochee River from its mouth to the head of navigation," and I have now the honor to submit the accompanying report of December 20, 1897, with three maps,* by Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, of the results of the survey under the terms of the last-mentioned act, which includes the locality required to be surveyed under the provisions of the act of 1894.

Colonel Benyaurd estimates that it will cost $120,000 to secure at the mouth of the river a channel 100 feet wide and 6 feet deep at mean low water, and this, he states, would permit vessels of 5 feet draft to ascend the river to a point 12 miles above its mouth; thence a railroad about 15 miles in length would reach the main body of the phosphate deposits, and there seems to be no question, so he reports, that this railroad would be built at once if the entrance to the river was improved. He considers the river worthy of improvement to the extent and at the estimated cost stated.

A study of the character of the stream indicates that the only feasible method of making the river navigable to the vicinity of the phosphate mines is the construction of a system of locks and movable dams, at an estimated cost of $423,495.65, but their construction at the present time is not recommended.

Should the future development of commerce on the river warrant so large an expenditure as would be required for the establishment of a system of slack-water navigation, the question of the construction of locks and dams can then be considered.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. R. A. ALGER,
Secretary of War.

REPORT OF LIEUT. COL. W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
St. Augustine, Fla., December 20, 1897.

GENERAL: I have the honor to submit the following report of the survey of Withlacoochee River, Florida, from the head of navigation to the mouth, made in compliance with the river and harbor act of June 3, 1896:

For a general description of the Withlacoochee River and its needs in the way of improvement for the benefit of commerce, attention is invited to the report of Maj. T. H. Handbury, Corps of Engineers, United States Army, on a preliminary examination of the stream made in October, 1894, and published in the Report of the Chief of Engineers for 1895, page 1579 et seq.

It having been decided that the head of navigation could not reasonably be considered to be above Pembertons Ferry, the survey was not carried above that point. In 1892 a stadia survey of the river between the mouth and Jumpers Creek, 65½ miles above, was made and a line of flying levels run from Hodges Ferry to Morrisons Landing, 8 miles and

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* Not reprinted. Printed in House Doc. No. 199, Fifty-fifth Congress, second session.

45½ miles, respectively, above the mouth. From the data thus obtained a general idea of the character of the improvement required was obtained, and the recent survey was undertaken with a definite object in view, viz, to ascertain the amount and character of the material composing the obstructing shoals at the mouth, to investigate the character of the foundation existing at the most likely sites for the necessary locks and dams, and to obtain a knowledge of the general characteristics of the stream and the adjacent topography during the low-water stages and while in flood.

The survey was made under the immediate direction of Mr. J. W. Sackett, assistant engineer, and the field party was in charge of Mr. O. N. Bie. Active work in the field began March 15 and was completed May 22, 1897. The report of Mr. O. N. Bie, giving a detailed account of the field operations, is submitted herewith.

The Withlacoochee River traverses a valuable agricultural, horticultural, and timber region, and the advantages to be derived by opening it to navigation were early realized. With this end in view a detailed examination was made in 1879, the report being published in the Report of the Chief of Engineers for 1880, page 1111 et seq. It was ascertained that by removing snags and overhanging trees and improving the channel across the rock shoals to a slight extent a navigable channel for boats drawing 2 feet of water could be obtained during one-half of the year. This was undertaken, and in 1893 such a channel was pronounced as completed at an expenditure of about $24,000. Unfortunately, however, the fact remained that the period during which navigation was open did not correspond entirely with the season during which it is necessary to move the products of the region, and, as railroads have been built through various sections of the same country, giving regular communication, the commerce of the river was at a disadvantage and was confined to that portion of the river between Morrisons Landing and Pembertons Ferry. Immense deposits of phosphate of a fine quality have been discovered in the valley of this river since the improvement before mentioned was undertaken. The only means of getting the products of the mines to market is supplied by the railroads, and the cost of transportation to the nearest seaport amounts to practically one-half the value of the phosphate on board ship.

A study of the character of the stream indicates that the only feasible method of making the river navigable to the vicinity of the phosphate mines is the construction of a system of locks and movable dams of the Chanoine type and the improvement of the channel at the mouth so as to permit barges drawing 5 feet to be loaded at the mines and taken down the river to an anchorage about 7 miles off the mouth and there discharged into ships or seagoing barges.

Four locks and dams, having a lift of 7 feet each, would afford navigation for such barges at all stages to a point near Morrisons Landing, which covers all the rapid portion of the river. The cost of these locks and movable dams is estimated to be as follows:

Dam.	Location.	Lock.		Navigation pass.		Cost.
		Length.	Width.	Width.	Number of wickets.	
No. 1	Shoal No. 1	200	40	63	21	$106, 364. 65
No. 2	Shoal No. 2	200	40	87	29	110, 195. 30
No. 3	Long Rapids	200	40	66	22	103, 304. 60
No. 4	Shoal No. 9	200	40	66	22	103, 631. 10
	Total					423, 495. 65

The first three dams would reach the vicinity of a majority of the mines, and Dam No. 4 need not be constructed for some time to come. Excluding the cost of Dam No. 4, the total cost of the locks and dams would be $319,864.55.

The following is the estimated cost of a channel at the mouth, 100 feet wide and 6 feet deep at mean low water:

27,481 cubic yards of rock, at $2.50	$68,702.50
116,827 cubic yards of sand, at 25 cents	29,206.75
Construction of dam across south branch of river	4,000.00
Engineering and contingencies, about 15 per cent	18,090.75
Total	120,000.00

The improvement of the channel at the mouth to a depth of 6 feet would permit vessels of 5-foot draft to ascend the river to a point 12 miles above the mouth. From this point a railroad about 15 miles in length would reach the main body of the phosphate deposits. There seems to be no question that this railroad would be built at once if the entrance to the river was improved. Then, if the development of commerce, as a result of this improvement, would warrant the further improvement of the river, the question of the construction of locks and dams could again be taken up. At the present time it does not appear that the General Government would be warranted in making the expenditure that the construction of the locks and dams would entail. The improvement of the entrance to the river is considered worthy of being undertaken, and it is recommended that a project be adopted having in view the formation of a channel from the Gulf of Mexico into the Withlacoochee River, 100 feet wide and 6 feet deep at mean low water, at an estimated cost of $120,000.

The drafting and the tedious computations connected with the preparation of the estimates submitted were done by Mr. E. B. Thomson.

The following maps are submitted herewith:

1. Map of river from mouth to Morrisons Shoal.
2. Map of river from Morrisons Shoal to Pembertons Ferry.
3. Entrance to bar.
4. Profile of river from its mouth to Pembertons Ferry.*
5. Map of Shoals Nos. 1, 4, Long Shoal, and Crazy Rapids.*
6. Map of Long Rapids and Shoal No. 5, or Renfro Rapids.*
7. Map of Shoals Nos. 8 and 9.*
8. Map of Shoals Nos. 11, 12, and 13.*

Also copy of report of Mr. O. N. Bie, with copy of letter of Mr. John L. Inglis.

Very respectfully, your obedient servant,

W. H. H. BENYAURD.
Lieut. Col., Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. O. N. BIE.

UNITED STATES SNAG BOAT SUWANEE,
Tampa, Fla., July 30, 1897.

COLONEL: I have the honor to submit the following report on the survey of the Withlacoochee River, made in compliance with instructions in your letter of February 20, 1897:

As a stadia survey of the river was made in 1892 from its mouth to Jumpers Creek, and levels run from Hodges Ferry to Morrisons Landing, the work assigned to me consisted in—

1. Checking previous line of levels and extending same to Pembertons Ferry.

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*Not printed.

2. Extending stadia survey to Pembertons Ferry.
3. Making a detailed survey of all probable sites for dams.
4. Making a survey from the mouth of the river to deep water in the Gulf of Mexico, sufficiently detailed to give the necessary information in regard to direction and cost of proposed 6-foot channels between those points.

After completing the Tampa Bay survey I proceeded with the U. S. snag boat *Suwanee* to the Withlacoochee River, arriving at its mouth March 13. Finding insufficient depth in the channel at high water to enter the river with the snag boat, Mr. J. M. Braxton, my assistant, with rodman, proceeded by team and rail to Pembertons Ferry and began the line of levels March 18. The same day, after having emptied our tanks and carried wood and lumber ashore, the snag boat entered the river and was laid up at Hodges Ferry.

1. LEVELS.

The datum plane used for the levels on the upper river was a bench mark established by Mr. Pemberton at the surface of the river in 1877, the river being then at the lowest stage known, and 1 foot lower than it was during our survey. From Pembertons Ferry to Istachatta the levels were run along the railroad embankment. Beyond that point it was necessary to deflect from the river, and in some instances several miles, owing to it being bounded by impenetrable cypress swamps and marshes. On April 2 Mr. Braxton and his party reached Morrisons Landing and connected his levels with bench mark of 1892. The levels were then continued along the river to a point about 3 miles below Hodges Ferry, and checked on all but two of the bench marks of 1892. The following table shows the elevations of the river with reference to mean low water at Hodges Ferry:

Elevation of water surface.	Place.	Distance of place from mouth of river.	Mean range of tide.
		Miles.	*Feet.*
0.0	Chambers Island	0.0	3.0
0.0	Hodges Ferry	7.9	1.9
1.5	At B. M. No. 2½	11.5	0.8
5.9	At B. M. No. 3	14.5	0.0
9.4	Blitches Ferry	16.5	....
14.9	B. M. No. 4¾	20.8	....
19.7	B. M. No. 5	27.7	....
19.9	Dunnellon Ferry	28.6	....
20.5	B. M. No. 6	31.2	....
24.5	B. M. No. 8	35.0	....
25.6	Stockton Ferry	38.9	....
30.8	Cowhead Cypress	45.6	....
32.9	Vincent Landing	49.1	....
33.1	B. M. No. 13a	51.5	....
33.2	Ferris Landing	52.4	....
33.5	Eichelbergers Grove	55.5	....
34.2	Rutland Ferry	57.2	....
35.5	Carlson Ferry	60.4	....
37.6	Pyles Landing	68.9	....
37.7	Petersons Landing	70.2	....
38.1	Wilsons Landing	73.6	....
39.5	Jones & Hanchy sawmill	79.5	....
40.3	Pembertons Ferry	82.2	....

2. SURVEY OF UPPER RIVER.

On March 19 I proceeded with the *Suwanee's* crew of seven men up the river to begin the survey between Pembertons Ferry and Jumpers Creek. The outfit consisted of naphtha launch, one large rowboat loaded with naphtha, boring apparatus, tents and camping utensils, and two small skiffs. After experiencing considerable delay in crossing numerous rapids, opening hyacinth and log jams, we arrived at Chatterton, one-half mile below Stokes Ferry, on the 22d. A bridge and dam obstructed the river at this point, and in order to get above this obstruction the launch and boats were hauled overland about 300 feet. Above Stokes Ferry the river was almost impassable, owing to log jams and grassy plats with less than 1 foot depth. On March 26 we arrived with our two skiffs at Pembertons Ferry, the launch and large rowboat having been left at Hays Ferry, as we were unable to bring them farther. The stadia survey was begun the same day, and connected with the survey of 1892 near Jumpers Creek on April 3. The survey, showing shore lines, height of banks, and soundings, was platted at every station on small field sheets of cross-section paper. This section of the river flows through cypress swamps and marshes, occasionally skirting high banks, and varies in width from 20 feet to over one-half mile. But few signs of habitation are found, except in the vicinity of Pemberton, Hays Ferry, and Istachatta, where several phosphate works are in operation. The Plant System Railway passes through the first and last named places, with a spur to the phosphate works at Hays Ferry. Phosphate from these points is shipped via Port Tampa.

During the destructive freeze in February, 1895, all of the orange groves were badly damaged, and some of them appear to be abandoned at present. As a result the steamers which formerly plied on this upper section of the river, transporting large quantities of citrus fruits, are laid up or sold. I was informed that the Plant System intended to run their little steamer *Sam Pyles* between Istachatta and other points on the upper river as soon as the river rose enough to enable it to cross the worst shoals. The boat draws, when loaded, about 22 inches. The river, during the whole time of our survey, was at the lowest stage known for twenty years.

3. SURVEY OF PROBABLE DAM SITES.

After completing the stadia survey of the upper river we proceeded downstream, checking the survey of 1892, as instructed. The 8-foot contours of the banks were located with reference to the present stage of river and plotted on the field sheets of 1892 from Stokes to Hodges Ferry. The first practicable site for a dam was found to be at Shoal No. 13, 38.5 miles from the mouth, as the banks above are too low and swampy. Detailed surveys, including borings, soundings, slope, and velocity of current and levels of banks were made of the following shoals, in the order named: Nos. 13, 12, 11, 9, 8, 5, Renfro Rapids, Crazy Rapids, Long Rapids, Long Shoal, Nos. 4 and 1, and plotted on separate maps to a scale of $\frac{1}{600}$. Rock was found at these shoals, either in large bowlders or in strata of hard limestone. These strata, ranging in thickness from 2½ to 4 feet, were in every instance so full of crevices and large holes that they would be unsafe as foundations for dams. Immediately under these strata are generally found either a layer of tough clay or hard-packed gravel, or both, which would make safe foundations. Current observations were taken in the river above Blue Spring Run and also in Blue Spring Run.

Volume of discharge of river was 271 cubic feet per second.

Volume of discharge of Blue Spring Run was 695 cubic feet per second. As a check a third observation was taken near Long Shoal, 13 miles below the point where Blue Spring Run empties into the River, and the volume of discharge found to be 940 cubic feet per second.

SURVEY OF MOUTH.

Survey of mouth began May 3 and was completed May 22. A base line of 5,001.7 feet was measured along the west side of Chambers Island and a series of triangles extended to points on the inner and outer reefs; soundings were located by two transits and reduced to mean low water at Chambers Island, as determined from daily tidal records extending over a term of sixty-one days. About 7,000 soundings and 127 borings were taken.

The Withlacoochee empties into the Gulf of Mexico at a point 18.9 miles south, 60° east from Cedar Keys. Chambers Island is situated in its mouth, thus dividing it into two outlets—west and southwest passes. Above Chambers Island and as far as Shoal No. 1 the river is in good condition and has a depth of over 6 feet. From personal knowledge of the previous condition of the mouth of the river I found that the southwest pass, which has been considered the main entrance, has shoaled considerably since my last trip, in 1894, for on that and previous trips we were able to enter the river with the *Suwanee* drawing 3½ feet on half flood, while on our arrival this spring five days were lost in attempting to enter, and not until the spring tide occurred did we succeed in getting inside of Chambers Island. This shoaling is attributed by some people to the débris from phosphate mines having been flushed into the river; others again claim that the shoaling took place during the southwest gale of September, 1896, which almost destroyed Cedar Keys and entirely submerged Chambers Island and adjacent coast line. From examination of the shoal I believe the latter opinion is correct.

The west pass has comparatively deep water as far out as northwest point of Chambers Island, but beyond this point it is blockaded by numerous oyster bars. About two-fifths mile outside of Chambers Island, and nearly at right angles to the general direction of the tide, is a chain of oyster bars underlaid with rock. About 1$\frac{3}{5}$ miles farther out, and almost parallel to same, is another chain of shell bars, thus forming a basin outside the river. A crooked 6-foot channel leads from this basin to deeper water outside, near the south end of the reef. In order to find the best line for a navigable 6-foot canal from deep water inside of Chambers Island to the Gulf, a careful examination was made of both passes. A line of canal was determined on, which runs on a continuation of the lower deep reach in the river and out through the west pass to the 6-foot curve in the basin. This line, which is shown on the two maps of the mouth, submitted herewith, may seem a little arbitrary, as by beginning the canal a short distance to the left, at the inner end of west pass, and making a slight deflection to the left, considerably less dredging would be required, but my first consideration was an easy and safe access to the canal for tugs and barges coming downstream on a swift ebb. The condition of the shoal between the outer reef and deep water in the Gulf I found to be about as shown on coast chart No. 179. The average distance to 3-fathom contour from Chambers Island is 16 statute miles, but at one point a bend in the contour to the eastward occurs, which would make it possible to bring 18 or 19 feet draft to within 7 miles of Chambers Island. Here the anchorage is sufficiently wide to enable a ship to ride with safety, except in the hurricane season. Concluding, I would respectfully state that the only improvements of this river which have suggested themselves to me as being at present worthy of consideration are: Deepening the channel through west pass to deep water in the basin and closing the southwest pass near inner end of canal by building a dam across the river, the materials for which (rock and logs) could easily be obtained along the river bank a short distance above.

If such improvements were made the phosphate companies would probably build a railroad from their mines in the vicinity of Dunnellon to Shoal No. 1, and lighter and tow phosphate to ships anchored about 7 miles outside of Chambers Island. Should it be decided to extend the improvements above Shoal No. 1 by a system of locks and dams, the building of which present no special local difficulties between Shoals No. 1 and 13, it would, in my opinion, be best to begin the improvements at the mouth in order to give shipping facilities for importing the material required for such locks and dams.

I was unable to get satisfactory statistics of the commerce of the river, but submit the following:

In 1894 the annual output of phosphate of sixteen companies was about 200,000 tons. Since that time the output, according to letter from Mr. John L. Inglis, president of the Dunnellon Phosphate Company, which is submitted herewith, has steadily increased. The value of phosphate rock has, however, decreased nearly 50 per cent, for whereas in 1894 the mine owners got from $5 to $6 per ton at the mines, it is now sold f. o. b. steamship at Tampa and Fernandina for $5.25 and $5.50 per ton. The average freight per ton to these points is $2.56. There is no pebble phosphate dredging going on in the river at present.

The following partly completed maps are submitted:

One map of river from Pembertons Ferry to Jumpers Creek, scale $\frac{1}{2400}$.
Thirteen field sheets from Pembertons Ferry to Jumpers Creek, scale $\frac{1}{2400}$.
Twelve maps of probable dam sites, scale $\frac{1}{600}$.
One map of west and southwest pass, scale $\frac{1}{2400}$.
One map of river from Chambers Island to deep water, scale $\frac{1}{10000}$.

Very respectfully, your obedient servant,

O. N. Bie.

Lieut. Col. W. H. H. Benyaurd,
Corps of Engineers, U. S. A.

LETTER OF THE PRESIDENT OF THE DUNNELLON PHOSPHATE COMPANY.

The Dunnellon Phosphate Company,
Rockwell, Fla., April 22, 1897.

Dear Sir: Yours of the 21st received and carefully noted. I embodied all the information you desire in a letter to Maj. Thomas H. Handbury, U. S. A., St. Augustine, Fla., on October 17, 1894.

The annual output of high-grade phosphate, tributary to the Withlacoochee River, is steadily increasing. The freight rates from points in this territory to Fernandina and to Tampa are, on the average, $2.56 per ton of 2,240 pounds, Fernandina and Tampa being the ports from which it is exported, over three-fourths of it going to Europe, principally Germany.

The value of the phosphate in the last two years has, however, declined, and is now being sold f. o. b. ocean steamship at Tampa and Fernandina at, say, $5.25 to $5.50 per ton.

If the bar of the Withlacoochee River was removed, making a depth at low water of, say, 7 feet, a large quantity of the phosphate referred to would find its way out by that river.

Would be pleased should you call here, and give you any further information you may desire.

Yours, truly,

John L. Inglis,
President Dunnellon Phosphate Company.

Capt. O. N. Bie,
U. S. Engineer Department, Citronelle, Fla.

APPENDIX Q.

IMPROVEMENT OF HARBOR AT KEY WEST, FLORIDA, AND ENTRANCE THERETO.

REPORT OF CAPT. C. H. M'KINSTRY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORK.

United States Engineer Office,
Key West, Fla., July 14, 1898.

General: I have the honor to forward herewith Annual Report on improvement of harbor at Key West, including entrance thereto, for the fiscal year ending June 30, 1898.

This work was in the charge of Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, until January 31, with Second Lieut. R. P. Johnston, Corps of Engineers, under his immediate orders; and since that time under my charge, with Second Lieut. R. P. Johnston, Corps of Engineers, under my immediate orders until June 20, 1898.

Very respectfully, your obedient servant,

C. H. McKinstry,
First Lieut., Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

IMPROVEMENT OF HARBOR AT KEY WEST, FLORIDA, AND ENTRANCE THERETO.

For a description of this locality, the requirements of commerce, the project adopted and its modifications, the methods used, the work accomplished, its cost, and the results obtained, see pages 1325 to 1327, Report of the Chief of Engineers for 1896.

The investigations attending the preparation of a project for the expenditure of the appropriation of $80,000, made in act of June 3, 1896, indicated the advisability of commencing the construction of the west jetty, which was decided upon. In selecting a site for this jetty two important considerations, more or less in conflict, presented themselves. Primarily it was necessary that the jetty be so placed as to produce scour over the buried rock channel discovered during the survey of 1889. It was desirable also to protect the channel from heavy wave action. A careful survey of the locality, having special reference to the development of the topography of the underlying rock, was accordingly undertaken. Owing to inclement weather this survey was not completed until February, 1897. A location for the jetty was recommended, and an estimate of the cost submitted, March 6, 1897. This was approved by the Department March 24, so far as the expenditure of the appropriation of $80,000, made by act of June 3, 1896, was involved.

Work under this contract began about December 1, 1897, and the first cargo of stone was deposited on the west jetty December 30. On June 2, 1898, work under the contract was suspended, by the authority of the Secretary of War, at the request of the contractor, during the continuance of hostilities.

Fourteen thousand nine hundred and eighty and one-tenth tons of stone have been deposited under the contract, forming a layer 40 feet wide from station 1300 to station 3180, and varying in thickness from 2 to 10 feet, crest width from 10 to 35 feet. It is expected to deposit about 45,000 tons under the contract. On June 6 and 7 soundings were taken on the bar between the jetties. The crest of the bar has moved westward (seaward) about 200 feet. The 15-foot contour on the outer slope is almost a straight line and approximately parallel to the 18 and 24 foot contours. The 15-foot contour on the inner slope has the same shape which was developed by the survey of June, 1896, but has moved seaward 200 feet. The channel across the bar has a minimum depth of 12 feet at mean low water.

The northwest channel is of very great importance, affording as it will, when the project for its improvement is completed, a short cut for deep-draft vessels entering and departing from Key West. The work should be pushed forward as rapidly as practicable, and with this end in view it is recommended that $225,000 be made available for the work during the fiscal year ending June 30, 1900.

The harbor at Key West is in the collection district of Key West, Fla., which is the nearest port of entry. Nearest light-house is the Northwest Passage Light. Nearest fort is Fort Taylor, Fla.

Money statement.

July 1, 1897, balance unexpended		$75,177.74
June 30, 1898, amount expended during fiscal year		24,583.79
July 1, 1898, balance unexpended		50,593.95
July 1, 1898, outstanding liabilities	$275.00	
July 1, 1898, amount covered by uncompleted contracts	42,172.34	
		42,447.34
July 1, 1898, balance available		8,146.61
Amount (estimated) required for completion of existing project		225,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		225,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations for improvement of northwest entrance, Key West Harbor, Florida.

August 2, 1882	$25,000	August 18, 1894	$80,000
August 5, 1886 (survey)	2,500	June 3, 1896	80,000
August 11, 1888	25,000		
September 19, 1890	40,000	Total	327,500
July 13, 1892	75,000		

Contract in force during the fiscal year.

Name of contractor.	Contract.	Date approved.	Date of beginning of work.	Date of expiration.
R. G. Ross	Jetty construction	July 8, 1897	Aug. 15, 1897	June 15, 1898

On June 2 contract was suspended, during continuance of present hostilities, by order of the Secretary of War.

COMMERCIAL STATISTICS.

Commerce of Key West, Fla., during the year ending December 31, 1897.

[Furnished by Mr. R. W. Southwick, agent Mallory & Plant Steamship Lines, and Mr. W. H. Chambers, auditor Florida East Coast Railway.]

Articles.	Gross tonnage (estimated).	Value (estimated).	Articles.	Gross tonnage (estimated).	Value (estimated).
Cigars	374	$3,200,000	Ship stores	1,246	$147,000
Fish and oysters	862	17,000	Sponges	137	430,000
Fruits	1,900	48,000	Tobacco	722	530,000
Grain	1,150	35,000	Vegetables	1,133	76,000
Hides	180	9,000			
Merchandise	27,582	2,464,200	Total	36,690	6,981,200
Pineapples	1,404	25,000			

Arrivals and departures of vessels for the year ending December 31, 1897.

[Furnished by George W. Allen, collector of customs.]

Kind of vessel.	Arrivals.		Departures.	
	No.	Tons.	No.	Tons.
Steamers	444	482,153	436	442,967
Sailing vessels	211	76,668	157	46,724
Total	655	558,821	593	489,691

Value of imports during 1897	$588,447
Value of exports during 1897	705,320

APPENDIX R.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

REPORT OF MAJ. F. A. MAHAN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Carrabelle Bar, Florida.
2. Apalachicola Bay, Florida.
3. Apalachicola River, the Cut-off, and Lower Chipola River, Florida.
4. Flint River, Georgia.
5. Chattahoochee River, Georgia and Alabama.
6. Choctawhatchee River, Florida and Alabama.
7. Pensacola Harbor, Florida.
8. Escambia and Conecuh rivers, Florida and Alabama.
9. Alabama River, Alabama.
10. Coosa River, Georgia and Alabama.
11. Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.

EXAMINATION.

12. Chipola River, Florida.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., July 20, 1898.

GENERAL: I have the honor to forward herewith annual reports of the river and harbor works under my charge * * * for fiscal year ending June 30, 1898.

* * * * * * *

Very respectfully, your obedient servant,

F. A. MAHAN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

R 1.

IMPROVEMENT OF CARRABELLE BAR AND HARBOR, FLORIDA.

DESCRIPTION.

The town of Carrabelle is situated about 20 miles east of Apalachicola, on Carrabelle or Crooked River, which empties into the north side of the St. Georges Sound. The river forms the inner harbor, which has a channel along the water front of the town varying in depth from 9 to 15 feet, with a width of 100 feet.

A bar 1 mile wide from the 10-foot contour inside to the same depth outside, with a depth not more than 3 to 4 feet at low water, obstructs the passage in either direction.

PROJECT OF IMPROVEMENT.

The river and harbor act of June 3, 1896, appropriated $10,000 to be expended in making a 10-foot channel from the mouth of the Carrabelle River to the channel in the bay. No estimate of the cost of this work has ever been submitted.

OPERATIONS TO JUNE 30, 1897.

A contract approved on June 11, 1897, was made with the Rittenhouse Moore Dredging Company, of Mobile, Ala., to cut the channel 10 feet deep, provided for by the river and harbor act of 1896.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1898.

Under contract with the Rittenhouse Moore Dredging Company, of Mobile, Ala. (approved June 11, 1897), the work of dredging a channel 10 feet deep and 53 feet wide was begun July 1 and ended August 7, 1897.

The dredging was commenced at a point bearing south 29° east and 850 feet distant from the lantern of the white-light beacon (old-channel range), and continued along a course NW. by N. $\frac{1}{4}$ W., toward the city of Carrabelle. After digging 975 feet, good water was reached, and the dredge was moved 850 feet along the same course toward the inner edge of the bar, where digging was resumed and 75 feet length of cut made before the appropriation was exhausted.

The total length of the two sections of channel dug was 1,050 feet, which involved the removal of 30,592 cubic yards of sand.

CONDITION OF IMPROVEMENT JUNE 30, 1898.

An examination of the channel made in May showed that the cut had not only held its own, but had apparently deepened since the dredging was done. This favorable condition may be due to the prevalence of moderate weather. Nothing can be predicted of the permanence of the channel until it has been tested by a southeasterly gale.

RECOMMENDATIONS AND ESTIMATES.

It is recommended that the dredging be continued to deep water in the river above the wharves, and that the channel be widened to 100 feet at the bottom throughout its full length. To widen the channel 47 feet and extend it 2,200 feet would involve an estimated removal of 35,000 cubic yards of sand and shells.

The commerce of Carrabelle, valued in 1895 at $600,000, will certainly increase with better channel facilities.

An appropriation of $10,000 can be judiciously expended in widening and lengthening the channel across the bar at the mouth of Carrabelle River.

Money-statement.

July 1, 1897, balance unexpended	$9,792.46
June 30, 1898, amount expended during fiscal year	9,792.46
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	10,000.00

Appropriations.

June 3, 1896	$10,000

R 2.

IMPROVEMENT OF APALACHICOLA BAY, FLORIDA.

DESCRIPTION.

Apalachicola Bay is a long, broad, and shallow sheet of water on the south coast of Florida. It is separated from the Gulf of Mexico by St. Vincents Island, Sand Island, and the west half of St. Georges Island. The bay, when continued to the eastward, forms St. Georges Sound, which is separated from the Gulf by the eastern half of St. Georges Island, by Dog Island, and by Dog Island Reef.

The line dividing Apalachicola Bay from St. Georges Sound runs from Cat Point, on the north shore, to Bulkhead Point, on St. Georges Island. On this line is found Bulkhead Shoals.

Access to Apalachicola Bay can be had through West Pass, between St. Vincents Island and Sand Island. This pass is rarely used, as there is no good anchorage inside.

The entrance to St. Georges Sound is through East Pass, between St. Georges and Dog islands.

Apalachicola Harbor is the deep water just inside of East Pass and north of Dog Island.

ORIGINAL CONDITION.

Apalachicola River enters Apalachicola Bay at about the middle of its north side. A bar exists at the mouth of the river. The depth of the water on it was originally about 3.5 feet. The width of bar between the 8-foot curves inside and outside varies; it averages 7,000 feet in round numbers.

The depth of water across Bulkhead Shoals was originally less than 4 feet.

PROJECT OF IMPROVEMENT.

The report of the examination of Apalachicola Bay is to be found in the Report of the Chief of Engineers for 1879, page 823. This report recommended that a channel 100 feet wide and 11 feet deep should be dug through the bar at the mouth of the river. If the results obtained by this cut were such as to warrant its enlargement, it was recommended that the width be increased to 200 feet. This project was approved. The cost was estimated at $100,000.

A survey of the mouth of the river and of the eastern part of Apalachicola Bay was made in 1891. As the results of this survey the above project was again recommended, and to it was added the recommendation that a channel 9 feet deep and not less than 100 feet wide should be cut through Bulkhead Shoals.

OPERATIONS TO JUNE 30, 1897.

The channel through the bar at the mouth of the river has never been obtained as recommended, owing to the insufficiency of appropriations. The width has never exceeded 100 feet. The depth has never exceeded 9.5 feet, as against 11 feet proposed.

The first cut was made during the winter of 1881 and 1882. It was begun at 11 feet inside the bar, and the depth of 11 feet was maintained for a length of 5,748 feet. Of this length 1,967 feet was 60 feet wide; 3,781 feet was but 30 feet wide. During 1883 the 30-foot cut was widened to 60 feet and extended to the 9.5-foot curve outside the bar. An additional cut 15 feet wide was made through the bar. Work done during 1884 left the channel in the following condition: Average depth, 9.5 feet; total length, 6,060 feet, of which 5,200 feet was 75 feet wide and 860 feet 60 feet wide. During the spring of 1885 the cut was partly reopened, it having filled up to an available depth of 6 feet. The reopening was made 4,177 feet long, 60 feet wide, and 9.5 feet deep.

During 1887 and 1888 the cut was reopened with the following dimensions: Length, 3,635 feet; width, 60 feet; depth, 9 feet.

An examination made in March, 1889, showed that the cut had shoaled to 4 feet in depth. The cut was reopened between November, 1889, and May, 1890, to a depth of 8 feet, with a length of 6,000 feet and a width varying from 80 to 90 feet. The cut was again reopened between November, 1892, and April, 1893, with these dimensions: 5,350 feet long, 120 feet wide at inner end and 100 feet at outer end, 8 feet deep.

An examination made in April, 1894, showed that the channel had shoaled, since the reopening in 1892–93, 2.5 feet for a length of 2,000 feet near the inner end.

A new cut 4,930 feet long, 100 feet wide, and 8 feet deep at low water was dug during January and February, 1896.

In May and June, 1897, a channel 8 feet deep, 50 feet wide, and 5,500 feet long was redredged through the bar at the mouth of the river. This was the fifth time this channel had been reopened. The dimensions proposed for it by the approved project have never been attained.

A straight cut 4,000 feet long, 120 feet wide, and 9 feet deep was made across Bulkhead Shoals between October, 1891, and February, 1892, and up to present date this channel shows no sign of filling.

OPERATIONS DURING FISCAL YEAR ENDING JUNE 30, 1898.

There having been no funds available for work during the year nothing was done.

CONDITION OF IMPROVEMENT JUNE 30, 1898.

The channel through the Bulkhead Shoals is in good condition; no change of depth is apparent.

The cut made through the bar at the mouth of the river one year ago has shoaled 2 feet, and now has an average depth of 6 feet at mean low water. The filling material consists of soft mud—aluminous silt precipitated from the fresh water where it meets the salt. This channel was the narrowest ever cut entirely through the bar, and therefore, with all other conditions unchanged, its meager width would favor a more rapid filling in.

The project for opening the bar has never been carried out, consequently it is impossible to say what the result might be if the channel were once opened to its full dimensions. It is certain, however, from past experience, that the maintenance of a channel 9 feet deep and 100 feet wide will require the removal of 50,000 to 60,000 cubic yards of material annually.

RECOMMENDATIONS AND ESTIMATES.

The commerce of Apalachicola demands a deeper and wider channel. Past experience has shown that the shallow channels dug heretofore (the only ones which the meager appropriations have permitted) have filled up very soon after being finished. It is possible that a wider and deeper channel, say 200 feet wide and 11 feet deep, might stand a better chance for remaining permanent. Such a channel would require the removal of 200,000 cubic yards, in round numbers, of mud, at a cost of $40,000. A longitudinal training wall along the left bank of the river might be of material assistance in keeping the channel open. Whatever improvement may be adopted, it seems clear that more or less dredging will have to be done every year.

An appropriation of $50,000 can be expended judiciously on this work during the year ending June 30, 1900.

Money statement.

July 1, 1897, balance unexpended	$10, 807. 47
June 30, 1898, amount expended during fiscal year	10, 425. 00
July 1, 1898, balance unexpended	382. 47
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	50, 000. 00

APPROPRIATIONS.

The following amounts have been appropriated from time to time for this bay:

March 2, 1833	$8, 700	August 11, 1888	$20, 000
July 4, 1836	10, 000	September 19, 1890	20, 000
March 3, 1839	9, 900	July 13, 1892	20, 000
June 14, 1880	10, 000	August 18, 1894	15, 000
March 3, 1881	10, 000	June 3, 1896	12, 000
August 2, 1882	25, 000		
July 5, 1884	10, 000	Total	182, 600
August 5, 1886	12, 000		

These appropriations were divided into two periods, separated by an interval of forty-one years, viz: From 1833 to 1839, $28,600; from 1880 to 1896, $154,000.

COMMERCIAL STATISTICS.

The following information has been furnished by Mr. William B. Sheppard, collector of the port of Apalachicola, Fla.:

The district of Apalachicola comprises that section of coast lying between Ocklockony Bay and Cape San Blas, with Apalachicola, a city of about 5,000 inhabitants, as the port of entry for the district and the county seat of Franklin County, being situated at the confluence of the Apalachicola River and Bay. Besides Apalachicola, a customs office has been established at Carrabelle, Fla., a small town about 25 miles east of Apalachicola, on St. Georges Sound, at the mouth of Crooked River. This office was established December 2, 1897.

The principal waterway in the district, the Apalachicola River, is formed and swelled by the Chattahoochee, which has its source in northern Georgia; the Flint River, which has its source in central Georgia, and the Chipola, rising in northern

Alabama, besides numerous small streams and creeks. These waters are all bordered by heavy growths of valuable cypress, pine, and ash, and other timber in lesser quantities.

The Chattahoochee and Flint rivers are navigated, respectively, as far up as Columbus and Bainbridge, Ga., by four lines of steamers, except in low water during the summer season, when Columbus can not be reached at times. This low water on the upper river, which has been especially marked the past two years, has proved a severe drawback to the transportation lines and an impediment to the milling interest of this district, as it is impossible for steamers to navigate the river, and dangerous to floating out timber rafts when the water is at such a low stage as it has been the past two summers. To obviate this as much as possible, the several transportation companies on these rivers now have four or five very light-draft steamers under course of construction, besides those which have been built within the last year.

The urgent need of deep water at this point is deeply felt all through the section of country bordering on the rivers mentioned above, and could the necessity be recognized by the proper authority and an 18-foot channel given Apalachicola, as was ordered surveyed in 1896, it would be of vast benefit to Georgia, Florida, and Alabama, of which States this port is the natural outlet for that part bordering on the Chattahoochee, Flint, and Apalachicola rivers. Most all of the timber and lumber shipped from the district comes down the Apalachicola River and has to be towed or lightered to vessels at their loading berths, now on the eastern side of East Pass, 25 miles from Apalachicola. This is done at an enormous expense to the lumber merchants, and a heavy loss of timber is often incurred in towing it across the pass.

The shipment of naval stores from Carrabelle has largely increased the past year, and bids fair to become an important factor in the commerce of the district. Here, again, the necessity for deep water is felt, as a great deal of this commodity has to be towed across the bay on lighters, when it could be shipped direct from here.

Owing to the depressing effect of the war on the lumber business, as well as the steep increase in freights, the business of the district has not reached the proportions it would have otherwise; but when peace is restored and capital begins its inevitable rush into Cuba, this district, owing to its near location to the island and the class of its timber, will find a large and ready market, and it is my opinion that the volume of business will be largely increased.

Appended is a statement of commerce compiled from custom-house statistics and estimated information:

	Number.	Tons.
Vessels entered from foreign ports	122	65,681
Vessels entered from coastwise ports	12	5,774
Total	134	71,455
Vessels cleared for foreign ports	91	48,890
Vessels cleared for domestic ports	55	26,891
Total	146	75,781

Value of cargoes shipped to foreign ports	$449,235
Value of cargoes shipped to domestic ports	380,911
Total	830,146
Tonnage duties collected	$2,929.07
Duties on imports	33.06
Total	2,962.13

	Number.	Tonnage.
Vessels which do not enter or clear at the custom-house, number and tonnage estimated:		
Arrivals	125	15,000
Departures	110	11,000
Estimated arrivals and departures of steamers plying the Apalachicola, Flint, and Chattahoochee rivers	750	89,600
Number of small vessels engaged in the traffic of the port	150	....

Amount of superficial feet of pine and cypress lumber shipped		39,647,000
Turpentine	casks	2,647
Rosin (280 pounds each)	barrels	73,204
Cattle	head	576
Fish and oysters (estimated)	barrels	4,000

In addition to the above may be mentioned the large output of dressed and kiln-dried lumber, shingles, laths, pickets, etc., by the five large firms at Apalachicola and two at Carrabelle; also the large shipments of canned oysters by the two extensive plants at Apalachicola.

R 3.

IMPROVEMENT OF APALACHICOLA RIVER, THE CUT-OFF, AND LOWER CHIPOLA RIVER, FLORIDA.

A reconnaissance of this river was made between November 29, 1872, and February 1, 1873. The report of this reconnaissance will be found in the Report of the Chief of Engineers for 1873, pages 698–699.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

The Apalachicola River is formed by the junction of the Chattahoochee and Flint rivers at the extreme southwest corner of the State of Georgia. It runs southwardly through the State of Florida and empties into Apalachicola Bay at the city of Apalachicola. It passes through the low swampy country overflowed annually by the freshets in the Chattahoochee and Flint. This annual overflow prevents the country adjacent to its banks from being used to any great extent for agricultural purposes. Plenty of timber, however, is to be found on both sides of the river.

The most serious obstacle to navigation found was at Moccasin Slough, 47 miles above the city of Apalachicola. During the civil war the Confederate authorities had placed obstructions here to prevent vessels belonging to the United States ascending the river. These obstructions caught trees, logs, and other floating materials to such an extent as to form an actual dam. The river, however, cut off from its natural course, forced a passage from about a mile and a half above the obstructions to the river Styx. This passage was 3,100 feet in length. Reaching the Styx, the water of the Apalachicola River followed it down a distance of three-quarters of a mile until it reached the original river again. It was very difficult to obtain an entrance to the slough by vessels coming down the river, for the reason that the slough bent abruptly, forming an angle of about 180°, and ran in exactly the reverse direction to the current of the river. Moreover, it is only from 80 to 100 feet in width, is very crooked, and has a swift current of more than 5 miles an hour, due to a fall of 2.8 feet. The passage through the slough and the river Styx is 2 or 3 miles shorter than the old channel through the Apalachicola River proper.

The depth of the water in the river from the junction of the Chattahoochee and Flint to Apalachicola is at all places more than 6 feet. Its length is about 105 miles, its width is about 150 to 200 yards. Every freshet from the Chattahoochee or Flint causes more or less obstruction to navigation by the lodgment of snags and logs in the Apalachicola River.

PROJECT.

The original project, submitted in 1873, was to widen and straighten Moccasin Slough and to remove all snags from the river, at an estimated cost of $80,333.

The act of August 11, 1888, directed an examination of the "Chipola River from its mouth to Wewahitchka, and the cut-off, and Lee Slough, running from the Apalachicola River to the Chipola River." As a result of this examination, made in 1889, the original project was extended so as to include a channel 60 feet wide and 5 feet deep through the cut-off, Lee Slough, and Lower Chipola River.

OPERATIONS TO JUNE 30, 1897.

A fairly complete synopsis of the work on this river from January 1, 1875, to June 30, 1895, will be found in the report of the Chief of Engineers for 1896, Part II, pp. 1348–1350.

1896.—No work was done during the year ending June 30, 1896, because there was no money.

1897.—The snag boat *Flint* worked three months on the Apalachicola, the cut-off, and Lower Chipola rivers, and removed 1,520 overhanging trees, 928 drift trees, and 1,206 bushes from the banks, and 624 logs and snags and 629 stumps from the channel.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1898.

In September, 1897, the snag boat *Chattahoochee* made a trip through this waterway and removed from the Apalachicola River 2 overhanging trees and 15 logs and snags; from the cut-off, 2 overhanging trees and 16 logs and snags; from the Lower Chipola, 107 overhanging trees, 5 stumps, and 41 logs and snags; at a total cost of $659.40.

CONDITION OF IMPROVEMENT JUNE 30, 1898.

The Apalachicola River and cut-off, with the exception of a few scattered logs which will cause trouble at extreme low stage of water, are in fair navigable condition.

The crooked and narrow channel through the Lee Slough portion of the Lower Chipola River is at present blocked to navigation with drift saw logs. These logs are, many of them, 3 feet and more in diameter at the large end, and sinking in a channel 5 feet deep they completely stop steamboats, while otherwise the boats could pass readily. The narrow and crooked condition of the stream certainly favors the lodgment of drift material; but the main trouble arises from the fact that heavy logs are continuously dropped from rafts, and the present laws are not adequate to reach offending and careless lumbermen.

REMARKS.

Mr. Thomas Robinson, the assistant engineer of this river, says:

> It was expected from appearances of the soil during the earlier work that the banks of the narrower portion of the Lower Chipola would erode readily, as soon as the timber was removed. Experience shows, however, that the older silt, a few feet back from the margin of the stream, has assumed a clay-like consistency, and is not easily acted upon by the current. If the channel through the old (Lee Slough) portion is to be further widened, a dredge of some sort must be applied to the work. Since this river forms, together with the Flint and Chattahoochee, one system of waterways, it would be economical to provide a dredge, jointly, for use on all these improvements.

I agree with Mr. Robinson that a dredge is a necessity for these streams.

RECOMMENDATIONS AND ESTIMATES.

The country bordering on the Apalachicola River depends almost entirely upon the river for its transportation. The completion of the improvement is essential to the development of the region.

There is still required $6,000 for the completion of the improvement. Of this amount $2,000 will complete the clearing of the cut-off and Lower Chipola River, according to the approved project of 1890; $2,000 will finish the improvement of Moccasin Slough and the Elbows, and $2,000 will be required to maintain the improvement. No special working plant is required for this river, as the snag boat of the Flint and Chattahoochee rivers can be used here when not in use elsewhere.

It is recommended, therefore, that $6,000 be asked for the completion of the work on this river, and for maintenance during the fiscal year ending June 30, 1900.

Money statement.

July 1, 1897, balance unexpended	$1,452.88
June 30, 1898, amount expended during fiscal year	978.78
July 1, 1898, balance unexpended	474.10
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	6,000.00

Appropriations.

May 23, 1828	$3,000	July 5, 1884	$1,000
April 23, 1830	2,000	August 5, 1886	1,000
March 2, 1831	8,000	August 11, 1888	2,000
June 23, 1874	10,000	September 19, 1890	2,000
March 3, 1875	10,000	July 13, 1892	5,000
June 18, 1878	8,000	August 18, 1894	5,000
March 3, 1879	5,000	June 3, 1896	5,000
June 14, 1880	2,000		
March 3, 1881	1,500	Total	72,500
August 2, 1882	2,000		

COMMERCIAL STATISTICS.

The commercial statistics of the Apalachicola River are so combined with those of the Chattahoochee and Flint rivers that a separation is impossible, and reference is made to the Flint River for figures.

R 4.

IMPROVEMENT OF FLINT RIVER, GEORGIA.

DESCRIPTION.

The Flint River rises about 20 miles southwest of Atlanta, in Georgia, runs nearly due south, bending a little toward the eastward, and finally joins the Chattahoochee River at the extreme southwest corner of the State of Georgia. The junction of these two streams forms the Apalachicola River. A survey was authorized by the river and harbor act of June 10, 1872. The survey was begun at Albany, Ga., in November, 1872, and finished in May, 1873. Obstruction to navigation on the Flint River was rock shoals, formed chiefly of loose rocks of various sizes, becoming more frequent in going up the river. The character of the bed, while increasing the cost of the work, will tend to make it more permanent.

PROJECT.

The project for this work proposes a channel 100 feet wide, with a depth of 3 feet at extreme low water from Chattahoochee, Fla., to Newton, Ga., a distance of 71¾ miles, at an estimated cost of $118,105; and from Newton, Ga., to Albany, Ga., a distance of 33¼ miles, at an estimated cost of $66,757, making a total of $184,862 for a distance of 105 miles.

The river and harbor act of June 18, 1878, called for an examination of the Flint River between Albany and Montezuma, Ga. This examination showed that the removal of logs and snags and overhanging trees throughout the entire distance, estimated at 77 miles, would give a navigable channel for light-draft steamers throughout the greater part of the year. This work was estimated to cost $15,100.

OPERATIONS TO JUNE 30, 1897.

A summary of operations to June 30, 1895, will be found in the Report of the Chief of Engineers for 1896, Part III, pp. 1352–1354.

1896. Above Albany, Ga.—Nothing was done.

1896. Below Albany, Ga.—Work was finished at Kennedy Shoals and begun at Sister Islands, where it was carried on until the appropriation was exhausted, October, 1895.

The work done was: Six stumps and 50 overhanging trees removed from the banks, 75 logs and snags removed from the channel, 1,667 cubic yards of rock removed, of which 1,033 cubic yards was placed in the spur dikes. The cost of the work, including laying up the boats, was $3,301.50.

1897. Above Albany, Ga.—Nothing was done.

1897. Below Albany, Ga.—The channel was finished through Sister Islands, Buck, and Dickerson's to Dry Bread Shoals, a distance of 3¼ miles, with the removal of 81 snags and 12 trees, and 1,510 cubic yards of rock, of which 842 cubic yards were placed in spur dikes.

CONDITION OF IMPROVEMENT JUNE 30, 1897.

Above Albany.—No commerce was attempted; therefore nothing is known of the condition of this part of the river.

Below Albany.—There was a navigable channel at all seasons between Albany and Dry Bread Shoals, 40 miles. Between Dry Bread Shoals and Bainbridge, Ga., 35 miles, navigation at low water was impossible on account of rocks. Below Bainbridge the river was in good navigable condition at all seasons for boats plying the Chattahoochee and Apalachicola rivers.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

The drilling barge and dumping flat, with their appropriate tools, have been lying up in charge of watchmen at Tea Cup Shoals, near Baconton, Ga. The snag boat *Flint* has been cared for on the Chattahoochee River.

No channel work was done, for the drilling barge was too decayed to risk moving it around among the rocks and swift water at the shoals. Some light repairs and painting to prevent further decay were done by watchmen on the cabins of the drilling barge and snag boat.

Plans were prepared for a new hull for drilling barge, and for a continuance of work upon Dry Bread and other shoals below them.

The costs for the year were:

Watchmen, twelve months	$720.00
Engineering, office and traveling expenses, paints, oils, and other materials for repairs	99.55
Labor (carpenter)	6.67

REMARKS.

In carrying on the work with present appliances, the bowlders are first broken by blasting. When the water is not too deep the fragments are removed by men wading in the stream, who hand them to their comrades upon the dumping flat. When the water is too cold or too deep for wading, grappling tongs are used to load the flat. The removal of rock in this way costs $2 per cubic yard. The price varies, however, with the condition of the stream during the working season. Men wading when the water is not over 4 feet deep will pick up by hand three times as much rock as they can grapple with tongs in 6 feet of water. A small dredging machine would handle this material more readily than it is possible with the present manual appliances, and would effect a saving of 75 per cent of the cost if it removed the obstructions as readily as it is believed it would; that is to say, an outlay of $6,000 for a dredge out of an appropriation of $8,000 would remove as much rock as the present method, and leave a good machine on hand for further work.

The drilling barge and dumping flat were built in 1889. The hulls of both are decayed beyond repair. It is doubtful, even, if they can be made to float until new hulls are built.

RECOMMENDATIONS AND ESTIMATES.

There is no question as to the advisability of continuing the improvement of this river from the mouth to Bainbridge. There is a stretch of bad river between Newton and Bainbridge which can be navigated with care during moderate stages, but it is impracticable at low water. As the low-water season is that of the removal of the cotton crop, the best trade of the year is lost to navigation. There is no doubt that if the river were in good condition at low water there would be a considerable increase in the commercial movement. It is recommended, therefore, that the work be continued hereafter as it has gone on in the past, except that a dredge and dump scows be built for the use of the Flint and Chattahoochee rivers, at a cost of $15,000, one-half of the cost being borne by each river.

The estimated cost of what is required for judicious expenditure during the coming year on this river is:

Five months of the snag boat *Flint*	$5,000
Eight months of the drilling barge	8,000
New hulls for drilling barge and flatboat	6,000
Dredging machine and two barges (one-half)	7,500
Total	26,500

Money statement.

July 1, 1897, balance unexpended	$3,918.90
June 30, 1898, amount expended during fiscal year	1,346.10
July 1, 1898, balance unexpended	2,572.80
July 1, 1898, outstanding liabilities	19.95
July 1, 1898, balance available	2,552.85
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	26,500.00

Appropriations.

For Chattahoochee and Flint rivers:

June 25, 1874	$25,000
March 3, 1875	25,000
August 14, 1876	20,000
Total	*70,000
June 18, 1878	10,000
March 3, 1879	7,000
June 14, 1880	20,000
March 3, 1881	$15,000
August 2, 1882	25,000
July 5, 1884	20,000
August 5, 1886	20,000
August 11, 1888	20,000
September 19, 1890	20,000
July 13, 1892	15,000
August 18, 1894	8,000
June 3, 1896	8,000
Total	188,000

COMMERCIAL STATISTICS.

For the Flint River alone the following statistics have been received:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—
		Light.	Loaded.		
		Inches.	*Inches.*		
Maud Alma	35	18	30	156	Albany, Newton, and Bainbridge.

FREIGHT CARRIED.

Articles.		Quantity.	Tons.
Cotton	bales	3,000	750
Cotton seed	sacks	10,000	1,000
Fertilizers	do	4,000	400
Hides and skins	packages	250	43
Lumber	feet B. M.	500,000	1,000
Provisions	packages	3,000	150
Grain	sacks	4,000	200
Miscellaneous freight	packages	750	75
Naval stores	barrels	8,000	1,200
Total			4,818

Estimated value of above freights in round numbers is $240,900.

Between Bainbridge and the mouth of the river the stream is well used by the steamers plying the Chattahoochee and Apalachicola rivers, and for the commerce of this section of the river reference is made to the following table:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Number of passengers.	Round trips.	Between—
		Light.	Loaded.			
		Inches.	*Inches.*			
Bessy Clary	34.20	12	24	....	5	Columbus, Bainbridge, Ga., and Apalachicola, Fla.
Naiad	173.44	24	48	1,657	20	
Queen City	160	24	54	1,961	22	
Apalachee	163.90	28	54	3,649	44	
Flint	135.57	18	54			

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* Of this amount $18,000 was expended on the Flint River.

FREIGHT CARRIED.

Articles.		Quantity.	Tons.
Cotton	bales	11,587	2,897
Cotton seed	sacks	7,394	740
Fertilizers	do	27,797	2,779
Hides and skins	packages	59	10
Live stock	head	135	81
Lumber	feet B. M.	48,000	120
Provisions	packages	93,539	4,677
Grain	sacks	20,876	1,043
Miscellaneous freight	packages	139,882	6,994
Naval stores	barrels	12,862	2,572
Sirup and honey	do	1,519	304
Cotton seed	sacks	3,403	340
Shingles		3,511,000	826
Brick		285,100	712
Total			24,095

The estimated value of above freight in round numbers is $1,445,700.

Amount of lumber rafted down the river is not known, but it is covered in the report for Apalachicola Bay, Florida.

R 5.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA.

GENERAL IMPROVEMENT.

Description and condition before improvement.—The Chattahoochee River rises in the extreme northern part of Georgia, whence it flows southwestwardly until it strikes the boundary line between Georgia and Alabama, at West Point, Ga.; thence it flows nearly due south, forming the boundary line between the States of Georgia and Alabama, and, farther on its course, between Georgia and Florida, until it joins the Flint, forming the Apalachicola River. The river does not become navigable until it reaches Columbus, Ga., an estimated distance of 224 miles above its junction with the Flint. Between these two points there are more or less of obstructions to navigation, but the records of this office are so incomplete that it is impossible to give any detailed information on the subject between Columbus and Eufaula.

The report of the survey of the Chattahoochee River, shown on pages 584, 585, Report of the Chief of Engineers for 1872, contains an estimate for the improvement of the Chattahoochee and Apalachicola rivers from Columbus, Ga., to Apalachicola, Fla., at a cost of $164,000. No project is made in that report.

In the Report of the Chief of Engineers for 1873, page 700, three estimates were presented, as follows:

1. For removal of snags, logs, and loose rocks, insuring a 4-foot channel between Eufaula, Ala., and the junction of the Flint, at low water, $63,333.
2. For straightening and widening this 4-foot channel to 100 feet, $81,914.
3. For deepening this channel to 6 feet at low water, 100 feet wide, $982,945.

The engineer officer then in charge of the improvement of the river stated in his annual report:

> I consider the improvement included in estimates Nos. 1 and 2 sufficient for the requirements of navigation. * * *

This would make the estimated cost of the improvement of this part of the river $145,247.

No estimate has been found of the cost of the portion between Columbus, Ga., and Eufaula, Ala.

PROJECT.

The project then adopted, and which is still in force, provides for a low-water channel 4 feet deep and 100 feet wide from Columbus, Ga., to Chattahoochee, Fla., an estimated distance of 224 miles, by the removal of snags and logs from the channel and overhanging trees from the banks, cutting a channel through the rock shoals, and deepening sand bars by works of contraction and shore protection.

OPERATIONS TO JUNE 30, 1897.

A summary of the work done on this river from 1874 to June 30, 1895, is to be found in the Report of the Chief of Engineers for 1896, Part III, pages 1357-1361.

1896.—The snag boat *Flint* started from Chattahoochee, Fla., on July 1, 1895, and cleared the river of all accessible snags up to Columbus, Ga. Work was suspended on August 15 for the lack of funds and the plant laid up.

A bad breach in one of the dikes of the contraction improvement at Woolfolk Bar occurred in October, 1895. It was repaired promptly and most judiciously by the assistant engineer in local charge, Mr. Thomas Robinson.

Work on the new hull of the snag boat *Chattahoochee* was well started during the last three months of the year.

1897.—The rebuilding of snag boat *Chattahoochee* was completed, and the channel between Columbus, Ga., and Chattahoochee, Fla., was cleared by the removal of 144 bushes, 751 overhanging trees, 146 stumps, 864 logs and snags, and 105 cubic yards of rock.

CONDITION OF THE IMPROVEMENT JUNE 30, 1897.

The river was in pretty good condition. There were left still some bars and isolated obstructions which require removal. These were found at St. Francis Bend, Rock Island, King Rock, and at other points where smaller amounts of work are required. A great deal was also needed in the way of repairs to the works at Hospital, Upatoie, and Shell Creek.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1898.

At the opening of the fiscal year the snag boat *Chattahoochee* was at work near Columbia, Ala. An accident to the machinery necessitated a return to Columbus, Ga., for repairs. On resuming work the old hull of the snag boat was towed from Burdocks Landing to head of Uchee Reach, and there placed as a jetty, 125 feet long, across the false channel on the Georgia side of the river. Landslides were removed between Fort Gaines and Columbia, a bank-protecting mattress was built at Widow Browns Bar, rock bowlders were removed from the vicinity of Rock Island, and snags, logs, and overhanging trees were removed along the whole river from Columbus, Ga., to Chattahoochee, Fla.

In September the river reached an excessively low stage, and Woolfolks Bar and Gunboat Bar completely stopped the boats. To help navigation in the quickest manner, the snag boat *Flint* was relieved of its shear frame, and pile driving machinery was transferred from the old barge to the steamer, piles and other materials were secured, and work was started at Woolfolks Bar. In the meantime, the snag boat was recalled from the lower river and set to work to open a channel through Gunboat Bar by means of road scrapers pulled by steam capstans. When the channel at Gunboat Bar was opened the snag boat moved up to Woolfolks and supplemented by scrapers the work done by the pile-driving crew. As soon as the dams and mattresses were completed at Woolfolks the pile driver was moved up to Mound Bar, and extensive repairs were made to the bank protection along the Georgia side of the river.

In November the pile driver was moved up to Hospital Reach, near Columbus, and ten days were spent in making repairs to old dams and in an attempt to open a channel through the bar.

The materials used in all new works and in repairs to old ones were piles, brush, and plank, fastened with bolts, nails, and wire, and ballasted with rock, concrete, and gravel. Gravel was used for all temporary purposes, and concrete in sacks was employed because the low river made it impossible to secure rock ballast.

At the close of November all channel work was done that the appropriation allowed, and the working plant was taken down to Burdocks Landing and laid up in charge of watchmen.

In the work above mentioned, scattered between Columbus, Ga., and Eufaula, Ala., 85 miles, there were removed 261 logs and snags, 1 stump, and 259 overhanging trees; and 43 cubic yards of rock were placed as ballast in old hull of *Chattahoochee.*

Between Eufaula, Ala., and Chattahoochee, Fla., 138 miles, were removed 782 logs and snags, 42 stumps, 568 overhanging trees, and 23 cubic yards of rock; 297 square yards of landslides were plowed, and 10 cords of brush were used in making bank protections.

At Gunboat Bar, 26 miles below Columbus, Ga., 902 cubic yards of gravel were removed, giving a channel 300 feet long, 40 feet wide, and 4 feet deep.

At Woolfolks Bar, 10 miles below Columbus, Ga., a channel 600 feet long, 66 feet wide, and 4 feet deep was secured by removing 2,200 cubic yards of sand and gravel, 78 logs, and 2 cubic yards of rock; and the placing of 148 piles, 40 cords of brush, 9,608 feet of lumber, 275 pounds of bolts, nails, and wire, 629 sacks, 44 barrels of cement (making 22 cubic yards of concrete), 800 pounds of old rope, and 218 cubic yards of loose gravel ballast in the construction and repairs of 210 feet of bank protection and 1,430 feet of dams and jetties.

At Mound Bar, 7 miles below Columbus, Ga., 26 logs and snags were removed; and 207 piles, 220 cords of brush, 4,456 feet lumber, 210 pounds bolts, nails, and wire, 439 sacks, 400 pounds old rope, 18 barrels of cement (making 16 cubic yards concrete), 122 cubic yards loose gravel, and 57 cubic yards rock ballast were used and 150 trees planted in the repairs of 1,740 feet of bank protection.

At Hospital Reach, 2 miles below Columbus, there were removed 27 logs and snags; and 57 piles, 12 cords brush, 1,050 feet of lumber, 25 pounds of wire and spikes, 32 sacks, 100 pounds of old rope, and 3 cubic yards of gravel ballast were used in the repairs of 230 linear feet of old dams.

The costs for the year are summed up as follows:

Rents, stationery, and engineering	$1,260.00
Wages and subsistence	6,867.86
Watchmen while plant was idle	595.24
Fuel and engineer's supplies	624.30
Dynamite, caps, etc	95.04
Repairs at foundries	781.19
Piles	471.25
Lumber	181.20
Bolts, nails, and wire	40.45
Sacks and cement	187.80
Total	11,404.33

CONDITION OF IMPROVEMENT JUNE 30, 1898.

The river is navigable to boats of light draft from Columbus, Ga., to Chattahoochee, Fla. The water is shallow and necessitates the use of warping ropes in Hospital Reach, St. Francis Bend, and other places, and it will be so every low-water season until the desired improvements are made. The channels opened at Woolfolks and Gunboat are clear, and since there was no freshet during the past winter very little drift has come into the channel.

NOTES.

While the following notes are not absolutely necessary to this report when considering the work which has been done during the fiscal year, it seems well to insert them at this point because they contain information, the result of a great deal of research by Mr. Thomas Robinson, the assistant engineer in charge of this river, which is not to be found anywhere else, so far as is known.

A. Gunboat Bar, originally known as Upper Race Pass, 26 miles below Columbus, Ga., derives its name from the lodgment there of the Confederate gunboat *Muscogee* in the spring of 1865. In early days of steamboating the Race Passes were troublesome places, and boats have lain there a month at a time. Since the wreck of the gunboat stopped there, however, no difficulty had been experienced at the place until the low waters of 1896 and 1897, when, owing to excessive low rivers, no boat drawing over 24 inches could pass the place. The material of the bar is clean gravel, compact on the surface, but readily moved under the joint action of scrapers and river current. In the emergency there was no time for a survey and formulation of a previous plan for the work. The snag boat was set to work to do the best it could with the means at hand to open a passage for boats. Nothing is known of the details of the river bed immediately above or below the bar, and so the probable permanency of the work can only be conjectured.

B. *Woolfolks Bar.* [Really a history of work done here.]—In early days, time now unknown, the State of Georgia appropriated money for the improvement of this bar. Under that authority current-deflecting works were constructed. These consisted of massive cribs built of pine logs and ballasted with granite. Of the extent of the work there is no record; the information here given was obtained from hearsay, and portions of the old works removed in 1895.

Work was begun by the United States in the fall of 1874, by the removal of the wreck of the steamer *Uchee* and the construction of a dam 275 feet across the old channel on the Alabama side of the river. The dam was constructed of framed cribs, ballasted with granite, and the hull of the steamer *Jackson* was sunk as a prolongation of the crib work. From this time on the work was prosecuted from year to year in the construction of jetties and bank protection, with a view to securing a clear, low-water channel along what appeared the *cheapest route*, the Georgia side of the river. In 1880 the work was considered complete. For several years the dead low-water channel was good, but there was always trouble and a stoppage of boats at moderate stages of water following a rise of the river. Thus, if the river rose to 10 feet, then fell to 4 feet, there would be trouble at Woolfolk's until the low-water channel scoured out, while all along the river elsewhere a 4-foot stage would be an excellent stream for purposes of navigation. The filling in of the low-water channel resulted from the fact that the low-water run, by artificial means, for economy's sake (sic) had been held around the convex rather than the concave bank of the river. The low-water channel was thus in eddy, and sand and mud were rapidly deposited.

In 1890 the works were badly out of repair. A survey was made of the whole bar, and it was deemed best to modify the original plan and build new works, so as to confine, so far as conditions would allow, the low-water channel to the high-water run. Accordingly, work was begun in 1893 by sinking the hull of the steamer *W. D. Ellis* to form a deflecting dam 125 feet long, and from that time until the close of 1897, when the work as planned might be considered finished, the work was pushed from year to year as rapidly as funds allowed. In the prosecution of the work (by building works of deflection and plowing and scraping to facilitate channel scouring) *fully one-half of the bar materials has been moved three times in succession*, and there is now gravel for the current to contend with at the lower end of the bar, where sand and mud only existed five years ago.

The history of the work on this bar emphasizes very clearly and forcibly the need of other methods than current scour, brought about by deflecting jetties and works of contraction, for the opening of channels through the bars of this and similar rivers. When the work was begun in 1893 a simple spit of gravel about 400 feet wide, nearly dry at low water, extended across the desired channel. Had there been a dredge to cut a channel through the bar and dump the 4,500 cubic yards of gravel into the old channel, the job would have been complete, and not one-fourth of the dam and jetty work—all built of perishable materials—would have been required. As it was, by the methods at hand the gravel could only be moved partly out of the channel, to wash in again at the next freshet and deposit further down the stream.

In the opening of this channel by training dams, plow and scraper, there were removed, in four seasons, a total of 14,177 cubic yards, and this, too, with the exception of 3,500 yards, from portions of the channel that were clear when the work was begun.

The channel is now opened, but to render it permanent some bank protection should be built along the Alabama side of the river above the bar.

A map showing conditions in 1890 and 1898 is herewith submitted.

RECOMMENDATIONS AND ESTIMATES.

Four boats have been run weekly between Columbus, Ga., and Apalachicola, Fla., going up the Flint River to Bainbridge, Ga., each trip; therefore the commerce of the Chattahoochee River warrants a good channel.

It is recommended that all the old works of improvement be put into good repair, and that the necessary new works be pushed as rapidly as possible. In order to do this, the plant must be made efficient by rebuilding the hulls of pile-driver barge and flatboat and the acquisition of a small dredging machine and two dump scows. Since the Flint, Chattahoochee, and Apalachicola rivers are all one system, it would be wise economy to build a dredge for their joint use. The cost of such a dredge and appliances would be about $15,000.

The estimated cost of what is contemplated for the Chattahoochee River is as follows:

Dredge and scows (half cost)	$7, 500
Removal of annual accumulation and snags, logs, etc	5, 000
Rebuilding hulls of pile driver and flatboat	5, 000
Repairs to works at Hospital, Upatoie, Shell Creek, etc	25, 000
Excavating and controlling the channel in and near St. Francis Bend	30, 000
Excavation of rock, etc., at Rock Island, Kings Rock, etc	21, 000
Total	93, 500

This amount can be expended judiciously and advantageously during the fiscal year ending June 30, 1900.

Money statement.

July 1, 1897, balance unexpended	$12, 535. 91
June 30, 1898, amount expended during fiscal year	11, 929. 01
July 1, 1898, balance unexpended	606. 90
July 1, 1898, outstanding liabilities	60. 10
July 1, 1898, balance available	546. 80
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	93, 500. 00

Appropriations.

February 24, 1835	$2, 000
Chattahoochee and Flint rivers:	
June 23, 1874	25, 000
March 3, 1875	25, 000
August 14, 1876	20, 000
Total	*70, 000
June 18, 1878	18, 000
March 3, 1879	15, 000
June 4, 1880	20, 000

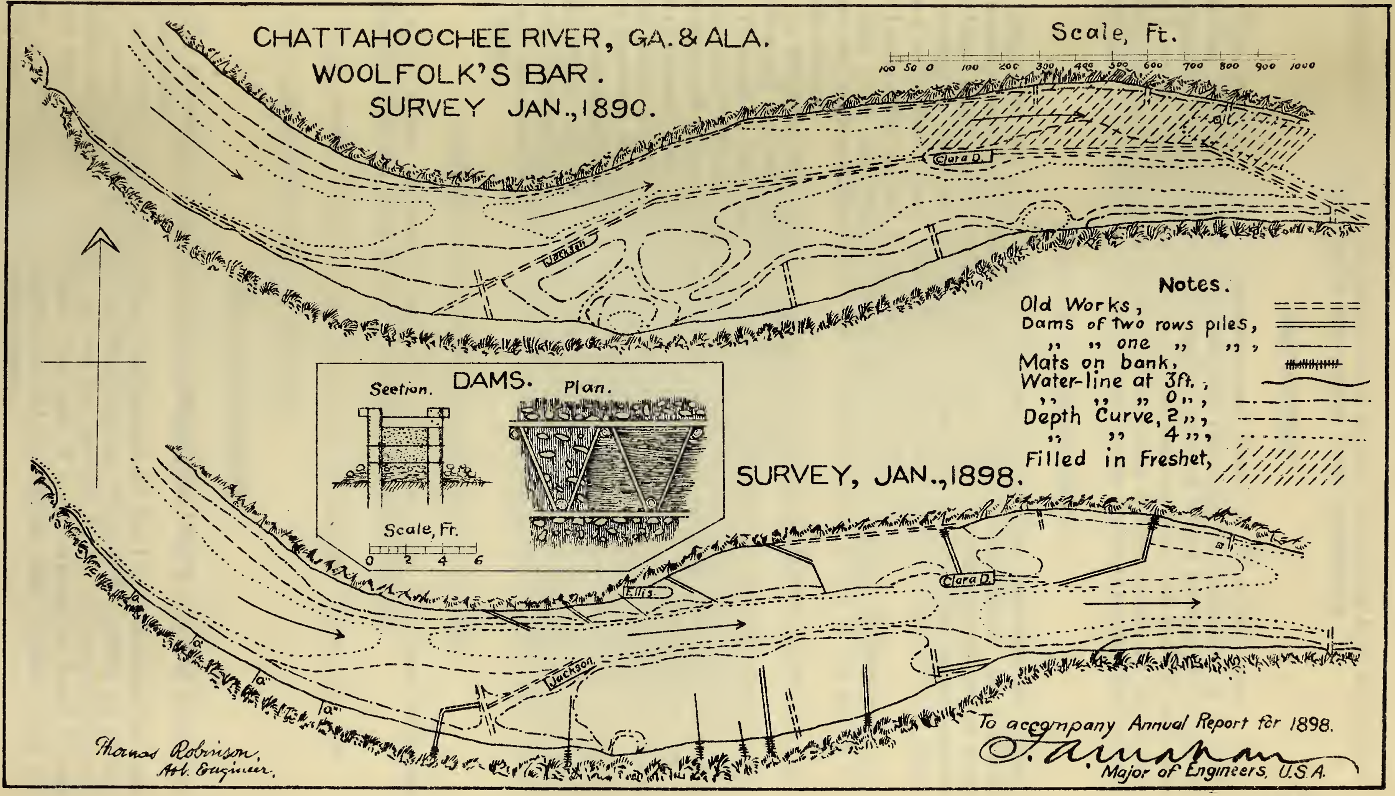
March 3, 1881	$20, 000
August 2, 1882	25, 000
July 5, 1884	35, 000
August 5, 1886	20, 000
August 11, 1888	20, 000
September 19, 1890	20, 000
July 13, 1892	†25, 000
August 18, 1894	†30, 000
June 3, 1896	†25, 000
Total	273, 000

* Of the joint appropriations $52,000 was expended on the Chattahoochee River.

† Of each of these appropriations $5,000 was to be expended between West Point and Franklin.

COMMERCIAL STATISTICS.

The commercial statistics for the Chattahoochee River are so combined with those of the Flint River that a separation is impossible, and reference is made to that river for figures.



CHATTAHOOCHEE RIVER, GA. & ALA.
WOOLFOLK'S BAR.
SURVEY JAN., 1890.

SURVEY, JAN., 1898.

Thomas Robinson,
Asst. Engineer.

To accompany Annual Report for 1898.

Major of Engineers, U.S.A.

IMPROVEMENT OF CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA, BETWEEN WEST POINT AND FRANKLIN.

DESCRIPTION.

This section of the Chattahoochee River is 38 miles long. It is divided into a series of pools, varying from one-half mile to 5 or 6 miles in length, by rock shoals and rapids, some of which have a fall as great as 8 feet in a mile. The width of the pools is from 300 to 500 feet, and their depth not less than 4 feet. The width of the stream at the shoals is from 800 to 1,000 feet, and the depth of the water is only a few inches.

PROJECT OF IMPROVEMENT.

The river and harbor act of September 19, 1890, provided for a preliminary examination of this section of the Chattahoochee. As a result of this examination, made in November, 1890, it was recommended that a survey be made for the purpose of founding a project of improvement and estimate of cost. The division engineer and the Chief of Engineers did not agree to this, so no survey was ever made.

The river and harbor act of July 13, 1892, allotted $5,000 from the general appropriation from the Chattahoochee River to be spent on this section.

In response to a call for a project for the expenditure of this sum, the following was submitted on July 26, 1892:

To remove the lesser rock shoals, sand, and gravel bars by excavation and works of contraction; to remove overhanging trees from the banks, and snags, logs, and other obstructions from the channel, and to overcome the more serious obstructions by the construction of locks and dams, to give a minimum depth of 3 feet at low water in the channel between West Point and Franklin, a distance of 38 miles.

Recommendation was made "that a party be organized for working the shoals between West Point and Bently Mill, and continue working until the shoals are put in as good condition as practicable, or until the funds are exhausted." These recommendations were approved August 5, 1892.

CONDITION OF IMPROVEMENT JUNE 30, 1896.

A low-water channel 50 feet wide and 3 feet deep had been obtained through Roberts, Flat Rock, and Haynes Island Shoals.

WORK DONE DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

No work was done during the year.

RECOMMENDATIONS.

The following recommendations, made year before last and last year, are renewed:

As much has been done on this section of the Chattahoochee as can be accomplished without undertaking an extended system of slack-water navigation. So far as can be learned there is no commerce on this part of the river, hence the cost of such expensive work would not be justified. It is recommended, therefore, that further work on this part of the river be abandoned.

As the last allotment made is insufficient to do any work on an extended scale, it is further recommended that nothing more be done for the present.

As this part of the Chattahoochee is not worth improving, no estimate for funds is made.

Money statement.

July 1, 1897, balance unexpended	$5,369.16
July 1, 1898, balance unexpended	5,369.16

APPROPRIATIONS.

An allotment of $5,000 was made from the river and harbor act of July 13, 1892, a second of the same amount from the act of August 18, 1894, and a third of the same amount from the act of June 3, 1896. In all, $15,000 has been given to this part of the river.

R 6.

IMPROVEMENT OF CHOCTAWHATCHEE RIVER, FLORIDA AND ALABAMA.

DESCRIPTION.

The part of the river considered for improvement is that from the mouth to Newton, Ala., an estimated length of 162 miles. It may be divided into four sections: (1) From the mouth to Caryville, where the Pensacola and Atlantic Railroad crosses the river, 100 miles; (2) from Caryville to Geneva, 25 miles; (3) from Geneva to Hollis Bridge, 30 miles; (4) from Hollis Bridge to Newton, 7 miles.

The section below Caryville runs through a sparsely-settled country, where the business is almost exclusively the cutting and rafting of timber.

The second section is the most used, nearly all of the commerce of the stream being here.

The third section is used as far as Pate Landing (25 miles above Geneva) when freight is offered at favorable stages of water.

The fourth section can not be used during low stages of water.

The second and third sections were of very difficult navigation, as the channel was greatly obstructed by snags and logs. During times of low water sand bars offered an additional hindrance to the commerce of the stream. A series of nine shoals, formed by strata of compact blue clay, makes low-water navigation impossible between Hollis Bridge and Newton. When the project for the improvement of the Choctawhatchee River was adopted the town of Newton was dependent on the river for communication with the outside world. The Alabama Midland Railway has been completed since then from Montgomery, Ala., to Bainbridge, Ga. This road passes through Newton, consequently the urgent necessity for improving the fourth section of the river exists no longer.

THE ORIGINAL CONDITION OF THIS CHANNEL.

Before work was commenced on this river the channel way was much obstructed by large and dangerous snags, by sunken logs, by overhanging trees, and by shoal bars, which consist of gravel and coarse sand.

This much obstructed channel way was not at all available for the amount of commerce which passes between Caryville, Fla., a station on the Pensacola and Atlantic Railroad, and the town of Geneva, Ala., which is entirely dependent on the river for the receiving and shipping of supplies and products.

PROJECT.

The project of the improvement of the Choctawhatchee River proposes to obtain a low-water navigable channel from the mouth of the river to Newton, Ala., by the removal of logs and snags from the channel and overhanging trees from the banks, by cutting through the rock shoals, and deepening sand bars through the medium of contraction works and protection for the shores.

This project has since been amended to require a draw, approved by the Secretary of War, to be placed in Hollis Bridge before any money may be spent above this bridge.

The estimated cost of the project of 1872 was $34,332. This estimate revised in 1880 increased the cost to $112,832.

OPERATIONS TO JUNE 30, 1897.

A condensed account of the work done on this river from 1874 to June 30, 1895, may be found in the Report of the Chief of Engineers for 1896, Part III, pages 1366–1370.

1896.—No works of contraction were carried on. The snag boat made two trips over the river from Caryville, Fla., to Geneva, Ala. The most dangerous obstructions were removed on the first trip. The second trip saw the removal of practically all snags and logs from the channel.

The following obstructions were cleared out: Thirty-nine overhanging trees felled and cut up, 28 trees felled and pulled back, 61 stumps leveled on bank, 241 logs removed from drift piles, 306 stumps removed from drift piles, 741 snags and 965 logs taken from the river.

1897.—The snag boat made two trips between Caryville and Geneva between August 17, 1896, and January 9, 1897. The following obstructions were removed: Two hundred and fifty logs from drift piles, 1,027 logs from the river, 206 stumps from the channel, 106 stumps leveled on the banks, 652 snags from the channel, 97 overhanging trees felled and cut up, 285 overhanging trees pulled back, 1 overhanging tree trimmed, 10 cubic yards of rock removed from the channel, all at a total cost of $2,749.52.

CONDITION OF IMPROVEMENT JUNE 30, 1897.

The condition of the river is now much as it was. Boats run regularly at low water between Caryville and Geneva, even at night.

Some of the contraction and training works are in need of repairs and extension. The materials of which they are made are not very durable as a rule, consequently much has to be done in the way of renewal and rebuilding. These works have done such excellent service in the past and have accomplished so much at exceedingly small cost that it is most economical and advantageous to keep them in good condition.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1898.

As no funds were available for work, the public property only was cared for.

RECOMMENDATIONS AND ESTIMATES.

Mr. Turtle, the assistant engineer in local charge of this river, says:

> It is respectfully recommended that the snag boat be kept at work each season removing such obstructions as are brought into the river during the high stages of water, and that the pile driver be employed for about two low-water seasons continuing contraction works at a few of the shoalest bars and preventing caving banks by driving longitudinal rows of piles.
>
> The character of the contraction works and bank protection employed have secured very satisfactory results, and their continuance is recommended.
>
> The necessary work of maintenance is growing less each year, and in the future the snag boat can greatly assist in placing contraction work.
>
> To obtain economical and most permanent results, this work should be prosecuted for a few seasons without any delay, after which the work of maintenance alone would be required.
>
> Contraction works should be put in at several bars, and it should be done before the present plant now on hand for that purpose becomes unserviceable. A pile-driving barge and quarter boat were built for this class of work in 1892, and since then the funds admitted of but one season's work with them.
>
> If the next sum appropriated for this improvement be such as to justify pushing works of contraction for two seasons, this portion of the plant might be disposed of, or its decay would not be of much importance.

I agree fully with Mr. Turtle. It is now six years since the pile-driving barge and the quarter boat were built, and during this time the small appropriations made for this river have allowed the use of these vessels for one season only. The wastefulness of such a course is manifest to the least thinking. Five years of deterioration to one of work!

The sum of $20,000 can be expended economically and advantageously during the year ending June 30, 1900, to be used as follows:

Snagging, etc	$4,000
Repairs to present works	4,000
New contraction works	12,000
Total	20,000

Money statement.

July 1, 1897, balance unexpended	$1,638.39
June 30, 1898, amount expended during fiscal year	879.84
July 1, 1898, balance unexpended	758.55
July 1, 1898, outstanding liabilities	50.00
July 1, 1898, balance available	708.55
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	20,000.00

Appropriations.

March 3, 1833	$5,000.00
June 15, 1844, for Choctawhatchee and Holmes rivers	10,000.00
June 25, 1874	5,000.00
March 3, 1875	5,000.00
August 4, 1876	5,000.00
March 3, 1879	5,000.00
June 14, 1880	7,000.00
March 3, 1881	10,000.00
August 2, 1882	18,000.00
July 5, 1884	15,000.00
August 5, 1886	15,000.00
August 11, 1888	$10,000.00
September 19, 1890	12,500.00
July 13, 1892	12,500.00
August 18, 1894	6,000.00
June 3, 1896	5,000.00
Total	146,000.00
Carried to the surplus fund, 1852	2,123.38
Balance	143,876.62

COMMERCIAL STATISTICS.

Captain Z. T. Morris and the Geneva Transportation Company, of Geneva, Ala., and Capt. J. C. Davis, of Vernon, Fla., report the following commercial statistics for the fiscal year ending June 30, 1898:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Between—
		Light.	Loaded.		
		Inches.	*Inches.*		
Annett	104	22	36	81	Geneva, Ala., and Caryville, Fla.
Mary Alice	39.37	18	30	25	
Ruth	42.49	16	30	105	
Teedle Clark	29	14	30	118	
Joe Davis	95.56	16	24	125	
Vernon	61.39	20	42	18	Vernon, Fla., and Pensacola, Fla.

FREIGHT CARRIED.

Articles.		Quantity.	Tons.
Cotton	bales	9,237	2,309
Fertilizers	sacks	24,000	2,400
Hides	packages	325	56
Staves		7,100	71
Provisions	packages	23,878	1,190
Grain	sacks	33,450	2,954
Lumber	feet. B. M.	250,000	500
Miscellaneous freight	packages	59,622	9,937
Rosin	barrels	13,477	2,695
Turpentine	do	1,305	196
Total			22,308

The estimated value of the above freight in round numbers is	$1,400,000
The estimated value of logs and timber is	1,000,000
Total	2,400,000

R 7.

IMPROVEMENT OF PENSACOLA HARBOR, FLORIDA.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENTS WERE BEGUN.

Pensacola Harbor, the finest harbor on the Gulf of Mexico, is at the extreme western end of the State of Florida.

Pensacola Bay is a large sheet of water of irregular shape, separated from the Gulf of Mexico by Santa Rosa Island, which is part of the littoral cordon of the Gulf.

Between Santa Rosa Island and the mainland lies Santa Rosa Sound, a strip of water 37.5 miles long and varying in width from an eighth of a mile to 2 miles.

A long tongue of land making in from the eastward separates Santa Rosa Sound from the greater part of Pensacola Bay. North of this tongue of land Pensacola Bay divides into two arms, which have their axes nearly north and south. The west arm is called Escambia Bay, into the northern end of which empties Escambia River. The eastern arm is in two parts—East Bay, with its extension northward, called Blackwater Bay.

Pensacola Bay is 24 miles long from the extreme eastern end of East Bay to the entrance from the Gulf. Its total water surface, including

Escambia, East, and Blackwater bays and the western part of Santa Rosa Sound, is about 150 square miles.

The entrance to Pensacola Bay is at the extreme western end of Santa Rosa Island. The bay lies wholly to the east of the entrance. The passage through the gorge of the entrance is very deep, reaching at one point as much as 52.5 feet. Inside of the entrance and for a distance of 9 or 10 miles vessels drawing 30 feet of water can move easily and safely.

It is not easy to gain entrance to the bay. Access thereto is denied by a bar on which there is rarely, even at the deepest point, more than 21 feet of water at mean low tide. This bar is roughly elliptical in shape. Starting from the shore to the west of the entrance, at a point 1,900 feet beyond the front beacon of the McRee range, the axis of the bar swings around gradually to a point on the shore line rather more than 4,500 feet to the east of Fort Pickens. This curve may be divided into two unequal parts, one about two-thirds of its development from the west, the other about one-third from the east, the point of division being nearly midway between the 18-foot curves and in a depth of 21 feet, more or less, according to circumstances. The western two-thirds of the bar is called the Caucus Shoal; the eastern third is called the East Bank. Inside of this bar a shoal makes out from the western end of Santa Rosa Island. It is called the Middle Ground. It has its axis nearly north and south.

The passageway between the Caucus Shoal and the East Bank is called the outer bar; that between the Caucus Shoal and the Middle Ground is called the inner bar. A cut has been dredged several times to a depth of 24 to 26 feet across the inner bar. As its axis made always a wide angle with the direction of the currents, especially those of the ebb, the cut has closed up again soon after each opening.

The passageways across the outer and inner bars have been narrowed gradually. The nearest points of the various curves of depth have had the following distances between them at the dates mentioned:

Inner bar.

Distance between—	1822.	1856.	1890.	1895.	1896.	1897.
	Yards.	*Yards.*	*Yards.*	*Yards.*	*Yards.*	*Yards.*
12-foot curves	2,050	1,525	2,050	2,000	....	....
18-foot curves	1,400	1,350	225	367	*a* 213	210
21-foot curves	1,125	1,050	*a* 667	*a* 133	*b* 367	*a* 62

a These measurements are taken along the sailing line. All the others are across it.
b This measurement is between the outside lines. Between them the water shoals twice to less than 21 feet and deepens once to more than 22 feet.

Outer bar.

Distance between—	1822.	1856.	1890.	1895.	1896.	1897.
	Yards.	*Yards.*	*Yards.*	*Yards.*	*Yards.*	*Yards.*
18-foot curves	1,925	1,100	850	693	775	666
21-foot curves	950	500	350	210	355	57
24-foot curves	875	1,075	1,000	1,157	1,017	1,133

In this table the distance between the 24-foot curves is measured in the direction of the sailing lines. The distances between the other curves are taken across the sailing lines to the nearest points of the curves.

Up to 1856, at least, vessels drawing not more than 18 to 20 feet of water could beat into the bay.

PROJECTS.

Project of 1877.—This project included only the removal of four wrecks, these being a ship of 1,200 tons, wrecked on the Middle Ground in 1869; a bark of 900 tons, wrecked alongside of the preceding in March, 1872; a steamer of 375 tons, wrecked about half a mile south of the light-house in 1864; a pilot boat of 34 tons, sunk in 4½ fathoms of water 1 mile north-northeast of the outer bar buoy on May 31, 1875.

Project of 1878.—This project, as definitely presented, was: First, to remove the above wrecks by contract; second, to make an examination or survey to determine the most advantageous expenditure of any remaining balance of the appropriation or for further recommendations for improvements.

Project of 1881.—This project was presented by the Board of Engineers of February 12, 1881. It provided for dredging a channel 300 feet wide and 24 feet deep at mean low water across the inner bar, and for protecting the shore line near Fort McRee from further abrasion by the construction of jetties and works of shore protection, with the view of preventing further injurious changes in the tidal currents and also of retaining the position for defensive purposes. The water on the inner bar was then only 19.5 feet deep. This project will be found in full in the Report of the Chief of Engineers for 1881, page 117.

Project for 1891.—This project, prepared by a special Board of Engineers, was presented July 16, 1891. It provides, briefly, for the building of two jetties, one from the west end of Santa Rosa Island, the other from the west side of the entrance of the bay, the jetties to have shore arms normal to the water line of the shore and to be of such length as to bring their outer ends 4,500 feet apart when finished. The jetties from the ends of the shore arms are to follow as nearly as possible the line of the ebb currents, and to converge toward each other so that the distance between them at their outer ends should be 3,500 feet. Dredging to hasten the opening of the new channel is also a part of the scheme. The full report of this Board may be found in the Report of the Chief of Engineers for 1891, page 1723.

First amendment to the project of 1891.—A special Board of Engineers, appointed "to reconsider the project for the improvement of the harbor of Pensacola, Fla.," presented its report on August 20, 1895. This Board made no change in the project of 1891. It recommended "that the engineer officer in charge be directed to take the necessary steps to secure immediately the use of one of the powerful hydraulic dredges now owned by the United States, and to open a channel 26 feet deep at mean low water and as wide as practicable on the line of the deepest water across Caucus Shoal, approximately on the line of the axis of the jetty channel recommended by the Board of 1891, and that he be authorized to use for this purpose as much of the funds now available as may be necessary." This report may be found in the Report of the Chief of Engineers for 1895, page 1657.

Second amendment to project of 1891.—This amendment was submitted by the same Board that recommended the first amendment, one officer having been added to the Board. It is as follows:

1. The Board recommends that all funds now available be expended in continuing the work of dredging across Caucus Shoal.

2. If funds sufficient for the construction of a suitable dredge and for its operation for a period of at least two years be made available by the next river and har-

bor act, the Board recommends that such a dredge be built and a channel opened across Caucus Shoal, at least 300 feet wide, having a least mean low-water depth of 30 feet, with such side slopes as the material will assume.

Until a channel be opened by dredging across Caucus Shoal, as herein proposed, the Board recommends that the construction of jetties for its economical maintenance be not further considered.

The existing conditions at the western end of Santa Rosa Island and near Fort McRee should, however, be maintained by the construction, if necessary, of suitable shore protection, which may be utilized as bases for jetties should their construction become imperative.

OPERATIONS TO JUNE 30, 1897.

A brief résumé of the operations at Pensacola up to June 30, 1895, can be found in the Report of the Chief of Engineers for 1896, Part II, pages 1375–1377.

1896.—The United States dredge *Gedney* was sent from New York to Pensacola, where it began work on the channel across Caucus Shoal on October 23, 1895. It continued work as weather and repairs allowed until the close of the year. A full account of its work and the cost thereof is given in the Report of the Chief of Engineers for 1896, Part III, pages 1377–1389.

1897.—The *Gedney* was still at work at the beginning of the year dredging in the Caucus Channel. Operations were suspended by reason of heavy weather on July 2, 1896, and were not resumed until July 13. The rudderstock was broken on July 17. The vessel had to go to New Orleans for repairs; it did not return until August 2. Meanwhile, Colonel Gillespie requested that it be returned to New York, so no further dredging was done.

An agreement was made with the Rittenhouse Moore Dredging Company of Mobile, Ala., to remove 200,000 cubic yards at 10 cents a yard. This amount was increased subsequently to 300,000 cubic yards. Work was begun on April 20, 1897; it was still going on at the close of the year.

The preparation of plans and specifications for a dredge was going on during all the latter half of the year.

CONDITION OF THE IMPROVEMENT JUNE 30, 1897.

The agreement with the Rittenhouse Moore Dredging Company of Mobile for removing 300,000 cubic yards of sand from the new channel through the Caucus Shoal expired July 19, 1897, at which time the least depth in the channel was 23.4 feet and the least width was 85 feet.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1898.

Dredging.—Work was going on at the beginning of the year under an agreement with the Rittenhouse Moore Dredging Company at the price of 10 cents per cubic yard. The stipulated amount of work came to an end on July 19, 1897, 300,424 cubic yards having been removed in all, and 90,559.3 cubic yards from July 1 to July 19.

A shoaling of the north end of the new cut having been noticed, a contract was made with the Rittenhouse Moore Dredging Company at 15 cents per cubic yard, the total cost to be $40,000. Work was begun under this contract on February 8, 1898. It is still going on. The total amount excavated to June 30, 1898, is 218,787 cubic yards.

The least depth in the channel is 25 feet deep at mean low water, with a least width of 100 feet.

The preparation of the plans and specifications for the construction of the dredge, which were well under way at the close of the year 1897, were completed. They were sent to the Chief of Engineers on September 7, 1897. They were referred to the Board of Engineers, who reported in favor of a smaller dredge on September 17. Work was begun immediately on the smaller sized vessel, of which the plans and specifications were sent to the Chief of Engineers on February 28, 1898. They were returned approved March 21, 1898. Bids were invited to be opened on May 21, 1898. Only one was received. This was at too high a figure to be considered.

Instructions dated June 17, 1898, having been received to prepare specifications for dredging by contract in the cut across the Caucus Shoal, these specifications were made up and forwarded to the Chief of Engineers for his action June 22, 1898.

SURVEY OF THE HARBOR ENTRANCE.

This work was begun on August 2, 1897, and finished on October 31, 1897.

The survey extended out to the 6-fathom curve, and included an area of 15.4 square miles. The plotting of this survey is about three-fifths done. Work had to be suspended on account of the war with Spain, as all hands had to be taken off for fortification work.

MISCELLANEOUS WORK.

The ranges marking various lines parallel to and east and west of the axis of the Caucus Channel have all been repaired substantially.

The range lights marking the axis of the Caucus Channel were maintained during the year until April 28, 1898, when they were extinguished as a war measure.

Repairs were made to the buildings used by the survey party, to the boats and the boathouse belonging to the harbor.

Other work was done in making maps, drawings, and tracings, in general office work, and in caring for public property.

CONDITION OF THE IMPROVEMENT JUNE 30, 1898.

Jetties—The jetties near Fort McRee are still in good condition.

Channels.—The old channel across the inner and outer bars is no longer available for vessels of any considerable draft. The mean low-water depth is not more than 20 feet over the inner bar, with a width of not more than 80 feet. Furthermore, the line of deepest water in this channel is quite crooked and can be used only for a much less draft than 20 feet.

The channel cut through the Caucus Shoal has a mean low-water depth of 25 feet, with a width between 100 and 125 feet. The assistant engineer in local charge of the harbor has tried to find the dimensions of the channel, but the state of the water has been such as to make accurate soundings impossible.

RECOMMENDATIONS AND ESTIMATES.

It is impracticable to make any clear recommendation or estimate at the present time. If a reasonable bid be obtained for doing the work called for by the specifications submitted on June 22, there will not be sufficient work left, in order to complete the channel designed by the existing project, to justify the building of a dredge. Consequently the assumption will be made that some contractor will build a dredge to do the work. If he were to build such a dredge as the one for which bids were asked, it would cost him about $120,000. His annual expenses would be, if the vessels were well built—

Interest on investment	$12,000
Depreciation (first year) not over	6,000
Running expenses, including minor repairs	27,600
Insurance	1,800
Total	47,400

Or, say, $50,000 in round numbers. Add to this the pay of the inspectors, of the assistant engineer in local charge, the cost of the survey of the entrance to the bay, of maintaining lights, buildings, office expenses, etc., a total of $70,000 is reached which can be expended profitably during the year ending June 30, 1900.

Money statement.

July 1, 1897, balance unexpended		$224,083.94
June 30, 1898, amount expended during fiscal year		65,263.94
July 1, 1898, balance unexpended		158,820.00
July 1, 1898, outstanding liabilities	$615.52	
July 1, 1898, amount covered by uncompleted contracts	18,868.67	
		19,484.19
July 1, 1898, balance available		139,335.81
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		70,000.00

Appropriations.

June 18, 1878	$20,000	August 11, 1888	$35,000
March 3, 1879	10,000	September 19, 1890	25,000
June 14, 1880	40,000	July 13, 1892	75,000
March 3, 1881	20,000	August 18, 1894	100,000
August 2, 1882	50,000	June 3, 1896	200,000
July 5, 1884	55,000		
August 5, 1886	20,000	Total	650,000

Abstract of bids received and opened by Maj. F. A. Mahan, Corps of Engineers, on December 13, 1897, for dredging at the entrance of Pensacola Bay, Florida.

No.	Name and address of bidder.	Time of commencing work.	Time of completion.	Price per cubic yard.	
1	Rittenhouse-Moore Dredging Co., Mobile, Ala.	Jan. 15, 1898	June 1, 1898	$0.15	Accepted.

Abstract of bids received and opened by Maj. F. A. Mahan, Corps of Engineers, on May 21, 1898, for construction of wooden-hull seagoing dredge for Pensacola Harbor, Florida.

No.	Name and address of bidder.	Time of completion.	Price.	
1	The Bucyrus Co., South Milwaukee, Wis.	8 calendar months from date of approval of contract.	$186,500	Rejected.

Alternative bid.

No.	Name and address of bidder.	Time of completion.	Price.	
	The Bucyrus Co., South Milwaukee, Wis.	12 calendar months from date of approval of contract.	$133, 000	Rejected.

Abstract of contracts in force.

Name and address of contractor.	Character of work.	Date of approval.	Work begun—	Expires—
Rittenhouse-Moore Dredging Co., Mobile, Ala.	Dredging...	Jan. 21, 1898	Feb. 15, 1898	Aug. 15, 1898

Extended by authority of Chief of Engineers.

COMMERCIAL STATISTICS.

The following information has been obtained from the collector of customs, port of Pensacola, Fla.:

Exports to foreign ports	$8, 214, 230
Exports to coastwise ports	279, 912
Total amount of exports	8, 494, 142
Imports from foreign ports	155, 390
Duties on imports and miscellaneous collections	4, 060

	Number.	Tons.
Vessels entered from foreign ports	362	369, 380
Vessels entered from coastwise ports	84	79, 295
Total	446	448, 675
Vessels cleared for foreign ports	375	397, 699
Vessels cleared for coastwise ports	87	64, 321
Total	462	462, 020

Coastwise exports.

	Quantity.	Value.
Lumber at $10 per M ... feet B. M.	8, 414	$84, 140
Coal at $2 ... tons	91, 750	183, 500
Pig iron at $10 ... do	280	2, 800
Shingles at $2 per M ... M	1, 850	3, 700
Phosphate at $4 ... tons	2, 073	8, 292
Total	....	282, 432

R 8.

IMPROVEMENT OF ESCAMBIA AND CONECUH RIVERS, FLORIDA AND ALABAMA.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

These two names apply to the same river, which is known by the name of Escambia from the boundary line between the States of Alabama and Florida to the mouth of the river, in Escambia Bay, an arm of Pensacola Bay, and the Conecuh north of the Florida and Alabama State line.

An examination of the part of the river lying south of the Alabama State line, a length of 100 miles, was made between the 19th and 28th of November, 1878. In this distance the width of the river is rarely less than 150 feet and often increases to 300 feet. The country through which it flows is, with but little exception, low, swampy, and subject to overflow for several miles on either side. At the mouth of the river, where it empties into Escambia Bay, there exists a bar on which the depth of water is not stated. The channel of the river was tortuous and was much obstructed by snags, logs, etc. There were also a few points to be cut off by means of dredging.

PROJECT.

The improvements suggested were to dredge a channel through the bar 150 feet wide and 5½ feet deep at mean low tide, to remove other obstructions, and construct a few dikes, wing dams, and shore protection, so as to give a good navigable channel of a minimum depth of 5 feet throughout its entire length, at ordinary low water. The original estimate of the cost of the improvement was $87,430.

OPERATIONS TO JUNE 30, 1897.

The operations on this stream from 1880 to June 30, 1895, are given briefly in the Report of the Chief of Engineers for 1896, Part III, pp. 1393–1395.

1896.—Work was carried on from the beginning of the year to December 20, 1895. During this time 24 overhanging trees were felled and cut up, and 4 trimmed; 215 logs cut up and stumps leveled on banks; 368 logs removed from drift piles; 110 stumps, 1,332 snags, and 43 logs removed from the river. The total cost of these operations was $2,757.40. The work extended over 56 miles of the river, in the part most dangerous to rafting and most difficult to maintain.

1897.—Snag boat worked over 25¼ miles of river below Brewton, Ala., from August 3 to December 5, 1896. During this time 32 overhanging trees were felled and cut up, 7 overhanging trees were pulled back, 189 logs cut up or stumps leveled on bank, 150 stumps removed, 84 logs removed from drift piles, 1,265 snags removed from river, 142 logs removed from river, 20 cubic yards of marl or clay excavated, all at a total cost of $2,589.85.

CONDITION OF IMPROVEMENT JUNE 30, 1897.

The river was in good condition for rafting, but the bar at the mouth was impassable for tugs.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1898.

No work was done during the year except to take care of the property, the funds being practically exhausted.

RECOMMENDATIONS AND ESTIMATES.

The most necessary work on this stream is the dredging of a channel through the bar at its mouth. It is impossible for tugs to go inside the bar to bring out the rafts which are floated down the river. It is necessary, therefore, to float out the rafts and tie them up in open bay. There they break loose sometimes and much valuable timber is lost.

It will cost $12,000 to dig a channel 100 wide and 8 feet deep through the bar.

The amount of snagging necessary to be done in the next year will cost $12,000.

The commerce of this river amounts to more than $2,000,000 a year. The amounts required to do the necessary work on this river are in all $24,000, or about 1 per cent of the annual commerce.

Money statement.

July 1, 1897, balance unexpended	$833.33
June 30, 1898, amount expended during fiscal year	612.71
July 1, 1898, balance unexpended	220.62
July 1, 1898, outstanding liabilities	44.50
July 1, 1898, balance available	176.12
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	24,000.00

Appropriations.

For Escambia River:	
March 2, 1833	$5,000
July 2, 1836	5,500
June 14, 1880	8,000
March 3, 1881	5,000
July 5, 1884	3,000
For Escambia and Conecuh rivers:	
August 2, 1882	12,000
July 5, 1884	12,000
August 5, 1886	12,000
August 11, 1888	10,000
For Escambia and Conecuh rivers—Continued.	
September 19, 1890	$7,500
July 13, 1892	8,000
August 18, 1894	6,000
June 3, 1896	4,000
Total	98,000
Carried to the surplus fund, 1838	5,500
Balance	92,500

COMMERCIAL STATISTICS.

The commerce of this river is principally the transportation of logs, lumber, and timber, and is carried to Pensacola, Fla., for export. The amount of this commerce is stated to be about 60 per cent of the export trade of the port of Pensacola, Fla., for the fiscal year ending June 30, 1897.

R 9.

IMPROVEMENT OF ALABAMA RIVER, ALABAMA.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENTS WERE BEGUN.

The Alabama River is formed by the junction of the Coosa and Tallapoosa rivers, which come together at a point 14 miles above Montgomery, Ala. The general direction of the stream is southwest from the junction of its affluents to Montgomery; from Montgomery to

Selma, Ala., it is nearly west; from Selma to the junction of the Alabama and Tombigbee rivers it is slightly west of south. The total length of the river is approximately 310 miles.

The normal width of the Alabama from Wetumpka to Selma is from 500 to 600 feet. From Selma to its junction with the Tombigbee it is from 700 to 800 feet.

As the river is made up of a series of pools and shoals alternating with each other, its depth varies greatly. More than 25 feet has been found in some pools and less than 2 feet on some of the shoals.

The fall of the river is unknown. No survey has ever been made. No continuous line of levels has ever been run. Its discharge has never been determined. There are no data available on which to found a systematic and comprehensive scheme of improvement.

The original condition of the river was very bad. It was so obstructed by logs, snags, and fallen trees in the channel, by overhanging trees on the banks, and by bars and shoals, on many of which the low-water depth was only 2.5 to 3.5 feet, that navigation was difficult and dangerous at all times. It was practicable only by day during the low-water season. Long detentions were frequent at shoals below Selma, and traffic was suspended between Selma and Montgomery when the water was low.

PROJECT.

The original project for the improvement of this stream (see Report of the Chief of Engineers for 1876, Part I, p. 498) looked toward making a channel 4 feet deep at low water, with a minimum width of 200 feet. This result was to be obtained by removing logs and snags from the channel and overhanging trees from the banks, by cutting through rock reefs and gravel bars, by blasting and dredging, by deepening the channel across sand shoals and bars by works of contraction, by stopping the caving and the washing of the banks by shore protection. The estimated cost of carrying out this project was $229,741.

First amendment.—The above project was amended. (See Annual Report Chief of Engineers for 1891, Part III, p. 1761.) The amended project differs from the original only in the depth to be obtained. This was put at 6 feet instead of 4 feet. The estimated cost of the amended project was placed at $386,251. Snagging operations and the maintenance of the increased depth when obtained were estimated to cost $10,000 a year.

OPERATIONS TO JUNE 30, 1897.

A brief account of the operations on this stream from 1879 to June 30, 1895, is given in the Report of the Chief of Engineers for 1896, Part III, pages 1397–1399.

1896.—All visible logs and snags were removed from the channel, and all overhanging trees from the chutes from Scotts Bend, 5 miles above Montgomery, to the mouth of the river. Work at Tate Shoals, suspended on December 15, 1894, was begun again in September, 1895, and completed during the autumn. A shore revetment was built on the left bank opposite the foot of the dike. The dike at Carter Shoals was repaired. A short dike was built half a mile below Dike No. 2, at Silver Creek Shoals.

An account of these works and their cost is given in the Report of the Chief of Engineers for 1896, Part III, pages 1400–1401.

A survey covering Turkey Ford, Mitchell, White, Rifleman, Upper, Middle, and Lower Sister bars was made. The length of river examined was 14.4 miles. (For methods and cost see the Report of the Chief of Engineers for 1896, Part III, pp. 1402–1403.)

1897.—All visible logs and snags were removed from the channel, and all overhanging trees were cut or trimmed on the banks of the various bar chutes from Scotts Bend, 5 miles above Montgomery, to the mouth of the river, a distance of about 298½ miles. The snag boat worked without interruption from July 30 to November 23, 1896. A dike was begun at Hurricane Bluff Bar on September 25 and was finished by November 15. A shore protection was built during the same time on the left bank opposite the dike. The working party was then moved down to Canton Lower Bar, 10 miles below Hurricane Bluff, where a dike was finished by December 3, 1896. Work was suspended December 5 on account of high water.

CONDITION OF THE IMPROVEMENT JUNE 30, 1897.

The zero of the gauge, or the low-water mark of this river, was established in 1889 from information obtained from the pilots of the steamboat lines, from planters along the river, and from river men in Montgomery and Selma. This zero, or low-water mark, appeared to be very nearly correct until the fall of 1895. During the fall of that year the river fell to 0.8 feet below zero, and during that of 1896 it fell to 1.5 feet below the zero of the gauge at Montgomery and to 2.25 feet below the zero at Selma. Owing to this unusually low stage of the river steamboats ascended for a short while only as far as Prairie Bluff, about 188 miles above Mobile, but they made regular weekly trips to and from this point.

The entire length of the river, so far as snags and overhanging trees were concerned, was in good condition when work was suspended.

The works of contraction, built since 1892, still remained in good condition, and the increased depth hereafter reported was maintained.

OPERATIONS DURING THE YEAR ENDING JUNE 30, 1898.

The repairs to the snag boat *Wm. J. Twining* were completed by July 10, 1897. The crew was organized, and the snag boat left Mobile for the mouth of the Alabama River, where snagging operations were begun on July 14. This work was continued until July 26, when it was suspended on account of a considerable rise, and the boat went up to Millers Ferry to await a fall. Work was resumed at this point on August 2, and continued through to Montgomery, a distance of 151 miles. This place was reached August 21. After coaling, the snag boat returned down the river to Hollingers Landing to work over the portion of the river between Hollingers and Millers Ferry, it having been omitted on account of the July rise. This work was finished by September 7.

The funds available for this improvement being practically exhausted, active operations were suspended. After rearranging the fleet for laying it up at Millers Ferry, housing in the snag boat and the steamer *Coosada*, and properly storing all property, the crew of the *Twining* was discharged on September 10, and the plant was left in charge of watchmen.

Amount of work done and its cost.

Class of work.	Number.	Cost per unit.	Total cost.
Overhanging trees felled and cut up	1,488	$0.094	$139.87
Overhanging trees trimmed	40	.39	13.60
Bushes cut (estimated)	80	.003	.24
Fallen trees cut up on bank	4	.68	2.72
Logs cut up on bank	9	.08	.72
Stumps cut level on bank	51	.15	7.65
Stumps removed from river	33	1.623	53.56
Trees and snags removed from river	294	2.26	664.44
Logs removed from river	44	1.94	85.36
Miles run by snag boat	666½	1.116	743.81
Miles of river worked over	293½	5.833	1,711.97
Coal consumed ... tons	41	2.768	113.48
Wood consumed ... cords	67¾	1.5534	105.25

Total expenditures on account of snagging operations.

Engineering, superintendence, and labor	$1,242.10
Subsistence	236.08
Fuel	218.73
Engine supplies and lights	7.71
Stationery, medicine, etc	7.35
Total	1,711.97

No works of contraction for the permanent improvement of the river were built during the year, nor were any repairs made to those previously constructed, as the balance of funds available at the close of the fiscal year of 1897 was only sufficient for the snagging that was absolutely necessary and for the preservation and repairs of the property during the year ending June 30, 1898.

The steamer *Coosada*, which had been laid up at Mobile during the spring of 1897, undergoing repairs, was ordered on July 14 to Millers Ferry, where it was laid up with that portion of the plant belonging to this improvement which was at that point. The towboat *John Mills*, laid up at Montgomery, was not in service during the year.

CONDITION OF THE IMPROVEMENT JUNE 30, 1898.

The lowest stage of water during the fall of 1897 was about the same as that of 1896. The gauge at Montgomery read 1.5 feet and the one at Selma 2.2 feet below zero, or what had been considered low-water mark previous to 1895. This latter low-water mark was the basis on which the estimated cost of the amended project was made, and should be borne in mind when considering the present condition of the improvement.

Prairie Bluff was, as in 1896, the head of navigation during the extreme low-water season of 1897, and steamboats made their regular weekly trips to that point except during the prevalence of the yellow fever quarantine.

All contraction works built since 1891 are still in fair condition, and the increase in depth caused by them is still maintained. The top layer of rock has been dragged off of a few dikes in places by passing drift and rafts; consequently they are below the required height in such places and should be repaired.

The season was excellent for snagging operations, but on account of the small amount remaining available for this purpose it was of short duration. The work done, however, was very thorough. The drift brought down the river and the trees brought in by slides and caving banks during the high-water season of 1897, together with several large logs that had been in the channel for many years, were all removed and the banks of the chutes were cleared of stumps and overhanging trees, as far as possible, from the mouth to Montgomery, a distance of about 293½ miles. At the close of the season the river was clearer of all such obstructions and was in better condition than ever before known.

The condition of the working plant belonging to this improvement is as follows: The snag boat *Wm. J. Twining*, which was overhauled and put in thorough repair during the spring of 1897, and the towboat *John Mills* purchased in 1895, are in excellent condition. The *Mills* should be docked, and the bottom and sides should be recalked for the better preservation of the boat.

The steamer *Coosada*, which was purchased in 1891–92 for the Lower Coosa River, and turned over to and repaired at the expense of this improvement, was an old boat when bought and is now nearly gone, but will last a year or two longer for light work.

The snag boat, built in 1886 for the Tallapoosa River, was transferred to the Alabama on the abandonment of the improvement of the former river in 1892. This boat was used for two seasons as a snag boat and, during 1895 and 1896, as a quarter boat by the survey party. It is now in a sinking condition. The rakes, gunwales, and head blocks, together with decks, are decayed throughout. The boiler, steam capstan, and all iron work of any value have been removed for safety. The boat is not worth repairing.

Pile driver No. 1 was the snag boat, built in 1890, for the Cahaba River improvement, and when that work was abandoned in 1892 the snag boat was transferred to the Alabama and used as such during one season. It was then changed into a pile driver and used for two seasons; since 1895 it has been utilized as a quarter boat for the dike gang. The boat is in pretty fair condition except the deck, which was partially renewed during the fall of 1897. With some additions to and a few changes in the cabin arrangements it will make an excellent quarter boat for the survey party, as it is of light draft and readily handled.

Pile driver No. 2, built in 1893, is in fair condition, and all machinery in good working order.

The hulls of the two quarter boats, built in 1892, are thoroughly decayed and are not worth repairing. One of them sunk twice during the past year; it was raised and towed to a point three-quarters of a mile above Millers Ferry and there abandoned. The other one may possibly last through another year. The two stone barges, the brush barge, and the two small pile barges, all built in 1892, have been worn out by constant service and are now no longer suitable for transporting material any distance, but can be utilized for a while longer as lighters at the site of the works. The two stone barges, built in 1893, are still in fair condition and will probably last two more years. The skiffs, tools, and general outfit are in good condition.

The following statement shows the total expenditures during the fiscal year ending June 30, 1898:

Cost of snagging operations		$1,711.97
Care and preservation of plant:		
Engineering and superintendence	$1,252.54	
Labor	1,866.73	
Materials	92.57	
Laundry	3.50	
Lights and engine supplies	46.54	
Fuel	132.23	
Subsistence	60.74	
		3,454.85

Transferring steamer *Coosada* to Millers Ferry	$129.92
Miscellaneous:	
Finishing repairs to snag boat *Twining*	161.74
Finishing repairs to steamer *Coosada*	8.00
Previous liabilities paid during the year	873.09
Outfit for the *Twining*	143.52
Travel, telegrams, and transportation of funds	9.39
Expenses of Montgomery office	791.97
Total	7,284.45

REMARKS.

The present project calls for practically a navigable depth of 6 feet at low water in the open river. This depth can not be obtained, as the water is not in the river. It is very doubtful whether even 4 feet could be maintained between Montgomery and Selma.

There is no survey of this river in existence which gives any information on which to found a complete scheme of improvement. Two local surveys have been made, one during the summer and autumn of 1895, covering a length of 14.17, miles in which are found these important bars, Turkey Ford, Mitchell, White, Rifleman, Upper, Middle, and Lower Sister; another in the autumn of 1896, covering 9.88 miles of river, and covering Upper Canton, Middle Canton, Lower Canton, Youngs, Mixons, and McGuires bars. These surveys were made for the purpose of obtaining data as to the action of the contraction works put in at the various bars mentioned, not only on the bars themselves, but also on the bed of the river in their neighborhood. There has been up to the present time no way of determining what this action is.

RECOMMENDATIONS AND ESTIMATES.

While much good has followed at the immediate point of application of contraction works, it is impossible to say what effect has been produced above and below them. No surveys exist whereby to make comparisons except just where the work is done, and such local surveys show only the changes in the depth at the point where the work stands. They do not show what has become of the material removed from the bar.

It is quite as important, nay, it is more important for the engineer to know what has become of this material and what effects have been produced at other points than it is to know that the depth has been increased. If a current strong enough to scour out a sand or gravel bar be brought to bear on the bar, material must be moved until a new channel be obtained of such dimensions as will reduce the strength of the current to that which is unable to set in motion any more of the bar. But the engineer ought to know what to do with this material before he sets it in motion. He should have decided on some definite place for its deposit where, if it can not be made to assist in the work of improvement, it will at least do no harm. A careful and accurate survey is required to acquire this knowledge. An accurate survey was made during the year 1896 of the neighborhood of Turkey Ford, Mitchell, White, Rifleman, Upper, Middle, and Lower Sister bars. A similar survey of Upper, Middle, and Lower Canton bars, of Mixons, McGuires, and Youngs bars, was made during the year 1897. With these surveys contraction works can be laid out much better than was the case formerly, and the results obtained can be followed better.

A small dredge and two dump scows would be a valuable as well as an economical addition to the plant of the Alabama River. As it is now, when the channels are cut through bars by means of contraction works, there is no control over the material which is carried down the stream. This material is deposited somewhere below and forms, frequently, another bar, which will have to be removed in the same manner as the one above, as is the case at Silver Creek Shoals. In some cases the crest of the bar gradually moves down the stream as the dike is being built, as was the case at Three Chutes, Hurricane Bluff, Silver Creek, and Tate Shoals, thereby causing a length of dike to be constructed greatly in excess of what would have been required had the material been first removed by dredging and deposited elsewhere. There are also shoals, such as Soapstone and Fishtrap, where the material is such that it can be removed only by blasting and dredging. The low-water channels at many bars and islands are filled with sand during the winter and spring freshets of every year, and are gradually washed out as the river falls, but in some cases, as the low-water stage is reached, the movement of the sand is very slow (as at Gardner Island), and causes much trouble and delay to steamboats for a short time. This could be relieved readily by a day or two of work by a suitable dredge. Furthermore, cuts could be made by dredging through bars where works of contraction are required, which would not only give quick temporary relief to commerce, but would also facilitate very greatly the handling of barges deeply loaded with material, thereby reducing very considerably the cost of the work. The cost of the improvement of the Three Chutes, Hurricane Bluff, and Shackleford bars would have been reduced at least 25 per cent by such dredging. A dredge which would be suitable for this work would cost about $12,000, and two dump scows would cost about $2,500 each.

It is believed that much good might be accomplished by placing across many of the deep pools of the Alabama River, ground sills of the sort which have worked so successfully on the Rhone and other European rivers, to raise the bottom and thus diminish the depth of water, giving better water in some places over the shoals and in other cases increased currents for cutting away bars. These ground sills would be valuable auxiliaries to the work of contraction, which have proved so successful in many cases.

As the river has a normal width of 500 to 600 feet from Wetumka to Selma, and of 700 to 800 feet from Selma to the mouth, it follows that this width must be reduced about 350 feet between Wetumka and Selma and 550 feet for the rest of the distance, in order to obtain the minimum width called for by the project. The total width of the surface of the water at many bars is much less than 200 feet. How then, is a channel 200 feet wide to be maintained across these bars? Manifestly, in part, by cutting down the crest of the bar; in part by reducing the depth of water in the pool above, and its low-water width. This means the construction of many miles of low-water dikes and many ground sills at great expense. No one can say what is needed in the way of ground sills or how many miles of dikes will be required, as there are available no data on the subject; hence the cost of such works can not be given. As the cost can not be given, it can not be said whether the commerce of the river will justify works so extensive.

No one can say what to do, because no one can say what should be done.

It is estimated that $187,000 can be expended profitably and advantageously during the year ending June 30, 1900.

This estimate is divided as follows:

Cost of dredging plant	$17,000
Cost of four stone barges	10,000
Cost of two brush barges	4,000
Cost of two pile barges	4,000
Cost of two quarter boats	6,000
Ordinary repairs to plant	5,000
Care of plant	6,000
Repair and maintenance of old work	10,000
Permanent works of contraction	75,000
Expenses of snagging operations	10,000
Expenses of dredging operations	20,000
Surveys preparatory to work	15,000
Expenses of Montgomery office	5,000
Total	187,000

The various barges and quarter boats called for in the estimates are to replace those worn out in service. All these vessels are in such condition as to make it uneconomical to repair them. They are too small for their work, which thus becomes unnecessarily expensive.

The small appropriations given heretofore have not allowed a full utilization of the working plant which belong to the Alabama River. Two towboats, two pile drivers, two quarter boats, two brush barges, and four stone barges will be again idle throughout the year ending June 30, 1899, for lack of funds necessary to keep them at work. The value of commerce on this stream is large. It is increasing all the time as the country becomes more populous. A large amount of cotton as well as of freight is deflected from the river business during the extreme low-water season.

Money statement.

July 1, 1897, balance unexpended	$8,363.63
June 30, 1898, amount expended during fiscal year	7,160.92
July 1, 1898, balance unexpended	1,202.71
July 1, 1898, outstanding liabilities	484.19
July 1, 1898, balance available	718.52
Amount (estimated) required for completion of existing project	246,251.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	187,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

June 18, 1878	$25,000	August 11, 1888	$20,000
March 3, 1879	30,000	September 19, 1890	20,000
June 14, 1880	25,000	July 13, 1892	70,000
March 3, 1881	20,000	August 18, 1894	50,000
August 2, 1882	20,000	June 3, 1896	40,000
July 5, 1884	10,000		
August 5, 1886	15,000	Total	345,000

COMMERCIAL STATISTICS.

The following statement of the business done by the steamboats named below during the fiscal year ending June 30, 1898, has been compiled from statements made by Capt. John Quill, of the steamers *Nettie Quill* and *Carrier*, and by Capt. T. H.

Moore, of the People's Line of steamers, plying between Mobile and Montgomery. No reports were rendered by the captains of the steamers *Minnie Lee* and *Alto*:

Stern-wheel steamboats.	Registered tonnage.	Draft.		Round trips.	Passengers carried.	Between—
		Light.	Loaded.			
		Inches.	*Feet.*			
Nettie Quill	299	29	6	28	2,440	Mobile, Selma, and Montgomery, Ala.
Carrier	140.88	24	5	23	810	
Tinsie Moore	198.29	30	5	42	4,194	
Minnie Lee	98	24	5	......	......	
Alto	363.16	30	7	......	......	
Barge Tide	320	10	3	......	......	
Barge Wave	320	10	3	......	......	
Barge Nellie	320	10	3	......	......	
Barge Mary	320	10	3	......	......	

Articles.		Quantity.	Tons.
Cotton	bales	41,734	10,433
Cotton seed	sacks	111,613	11,162
Fertilizers	do	89,281	8,928
Hides and skins	packages	2,481	417
Live stock	head	4,309	2,585
Lumber	ft. B. M.	130,789	261
Staves		222,766	2,228
Provisions	packages	280,109	14,005
Grain	sacks	198,500	16,542
Miscellaneous freight	packages	183,090	30,515
Brick	M	40,000	100
Total		......	97,176

Estimated value of above freight, in round numbers, $8,400,000.

In addition to the commerce carried on by the above boats, there was a large increase in the rafting business on this river. Very great quantities of sawn and hewn timber, saw logs, lumber, and cord wood are rafted to Mobile annually, but available records of this business are not kept, and no estimate can be made.

R 10.

IMPROVEMENT OF COOSA RIVER, GEORGIA AND ALABAMA.

1. BETWEEN ROME AND THE EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD BRIDGE.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

The Coosa River is formed by the Oostenaula and Etowah rivers, which have their source in the mountains of northern Georgia. The town of Rome, Ga., is situated at their junction. The Etowah is not navigable. The Oostenaula is formed by the junction of Coosawattee and Conasauga rivers, 60 miles northwest of Rome. The Oostenaula and its tributary, the Coosawattee, are navigable for light-draft boats the year round from Rome to Carters Landing, a distance of 105 miles. These rivers have been improved by works of contraction and channel excavation. There would be a continuous water route of transportation from Carters Landing to Mobile, Ala., an estimated distance of 815 miles, but for the shoals and rapids on the Coosa River, distributed over 137 miles, from Greensport, Ala., to Wetumka, Ala. This water route includes the Coosawattee, Oostenaula, Coosa, Alabama, and Mobile rivers.

Prior to 1823 the legislature of the State of Alabama passed "An act to improve the navigation of the Coosa River, and to aid in its connection with the Tennessee waters." In 1824 this act was formally approved by Congress.

In 1828 Congress provided that any surplus of the grant for improving Tennessee River should be applied to the improvement of the Coosa, Cahaba, and Black Warrior rivers.

It is not probable that much, if anything, was done under these acts, although steamboats have been plying on the upper Coosa for some thirty years. (See Report of the Chief of Engineers for 1881.)

Between Rome, Ga., and Greensport, Ala., an estimated distance of 173 miles, the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable.

From Greensport, Ala., to Wetumka, Ala., a distance of 137 miles, the improvement will require the building of locks and dams in conjunction with channel excavation and works of contraction.

PROJECT.

The original project for the improvement of the Coosa River contemplated the opening of a continuous water route of transportation from the Mississippi River to the Atlantic Ocean by the way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, with canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. This was designated as the "Southern Route." The low-water depth and width of the channel proposed can not be stated from the records at hand.

Various surveys and examinations were made between the years 1870 and 1890 of the part of the Coosa under consideration—i. e., from Rome, Ga., to the Selma, Rome and Dalton Railroad Bridge, now known as the East Tennessee, Virginia and Georgia Railroad Bridge (hereafter in this report the latter designation will be used)—an estimated distance of 245 miles. The following list gives the date of each and the estimates based upon them:

1870.—An examination from Greensport, Ala., to the East Tennessee, Virginia and Georgia Railroad Bridge, a distance of 72 miles. Estimated cost of improvement, $417,726.75.

1872.—A survey from Greensport, Ala., to the railroad bridge. No record can be found.

1874.—A survey from Rome, Ga., to the mouth of Wills Creek, 2½ miles below Gadsden, Ala., an estimated distance of 137 miles. Estimated cost of improvement, $180,000.

Summing up.—The total estimated cost of the improvement, determined from the above-described surveys, is as follows:

From Rome, Ga., to the mouth of Wills Creek, in Alabama, an estimated distance of 137 miles	$180,000.00
From Greensport, Ala., to the East Tennessee, Virginia and Georgia Railroad Bridge, an estimated distance of 72 miles	417,726.75
Total	597,726.75

The estimated cost of the improvement from Rome, Ga., to the railroad bridge is given in the Report of the Chief of Engineers for 1877, as follows:

From Rome, Ga., to Wills Creek, in Alabama, an estimated distance of 137 miles	$81,679
From Greensport, Ala., to the railroad bridge, an estimated distance of 72 miles	470,668
Total	552,347

No survey has been made nor has an estimate been submitted for the improvement of that section of the river between Wills Creek and Greensport, Ala., an estimated distance of 36 miles. The only improvement here was made at Leota Reefs, about 1 mile above Greensport.

1890.—A survey from Lock No. 4, situated at the foot of Broken Arrow Shoals, to the East Tennessee, Virginia and Georgia Railroad Bridge, a distance of 48 miles. Estimated cost of improvement, exclusive of the cost of Lock No. 4, $945,145.

The contemplated improvement was to be made by works of contraction at the lesser obstructions and locks and dams at the greater.

The estimates for locks and dams were made for structures with crib-chamber walls filled with loose stones and masonry head-and-tail walls laid in cement. The dimensions of the locks were 200 feet between miter sills and 40 feet wide. Before the building of the locks was begun the length between miter sills was changed to 210 feet, and it was decided to build masonry structures laid in cement throughout. It was proposed to secure a low-water channel 3 feet deep and 80 feet wide. Below Lock 3 the width and depth were afterwards changed to 100 feet and 4 feet, respectively.

By an act of Congress approved July 13, 1892, the restrictions as to the size of the locks imposed by the act of Congress approved September 19, 1890, were removed.

Beginning with Lock No. 4, the size of the remaining locks was increased. It is now, length over all, 400 feet; length between miter sills, 322 feet; width, 52 feet; depth over sills, 7 feet.

The channel improvement from Lock No. 4 to the East Tennessee, Virginia and Georgia Railroad Bridge now contemplates a low-water depth of 7 feet and a width of 100 feet.

OPERATIONS TO JUNE 30, 1897.

A summary of the operations to June 30, 1895, is to be found in the Report of the Chief of Engineers for 1896, Part III, pp. 1409–1416.

1896.—Nothing was done during this year for lack of funds, the appropriation for 1894 having been exhausted June 30, 1895.

1897.—The river and harbor bill of 1896 became available so late in the season that it was not deemed advisable to attempt any work on Lock 4 beyond collecting the material necessary to put in the cement floor.

Blasting and dredging was done at Box Shoals, and dredging at McCoy Island Reefs and Woods Reef. Repairs were made to Dam No. 4 and to the steamboat *Leota*, belonging to the improvement.

CONDITION OF THE IMPROVEMENT JUNE 30, 1897.

The river was navigable for light-draft boats the year round from Rome, Ga., to Harts Ferry, Alabama, 1 mile below Lock No. 3, an estimated distance of 180 miles. From Harts Ferry to Lock No. 4, a distance of 20 miles, the river was navigable on a 4-foot stage.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

At Horseleg Shoal, near Rome, Ga., two wing dams were built and old dams renewed. Dredging was done and sunken logs removed from the channel at Shorters Island and Mays Bars. Sand and gravel, for concrete, were dredged from the channel at McCoy Island, and the channel there improved by the amount of material removed. Dredging was done at the head of Box Shoals.

At Lock No. 4 the construction of the concrete floor and wall foundations was begun, and finished within the limits of the present coffer dam. The concrete work was completed a distance of 250 feet, leaving a length of 150 feet unfinished. In the prosecution of this work a cubical mixer 5 feet on the edge was used, and a maximum of 344 cubic yards of concrete, rammed in place, per day of eight hours was reached.

During extreme low water the leakage under the dam was so great that it became necessary to sink bush mattresses above and against the upstream face of the dam in order to keep the water at the crest.

The following statement shows the expenditures for the fiscal year ending June 30, 1898:

1898.			
June 30.	Disbursements July 1, 1897, to June 30, 1898	$25,469.35	
	Less obligations reported June 30, 1897	3,803.17	
			$21,666.18
	Outstanding obligations June 30, 1898; unpaid labor	1,449.67	
	Unpaid labor accounts, including services for June, 1898	581.99	
			2,031.66
	Unexpended material, stock on hand June 30, 1897		27,129.69
			50,827.53

Expenditures.

Unexpended material, stock on hand June 30, 1898		$14,457.97	
Addition to plant		262.21	
			$14,720.18
Channel work:			
Box Shoals, dredging			204.60
Between Rome, Ga., and Cedarbluff, Ala			2,842.80
Concrete floor (assembling materials, etc.)—			
Excavating gravity incline	$303.73		
Grading storage yard	84.04		
Building concrete cars	17.06		
Removing water tank	125.70		
Operating steamer	1,648.79		
1,302 cubic yards sand and gravel screened	542.69		
		2,722.01	
791 cubic yards filled in under floor	365.42		
346 cubic yards stone crushed	213.20		
		578.62	
2,300 cubic yards excavated for foundation	1,487.34		
Pumping	2,220.36		
		3,707.70	
Building forms	1,011.31		
5,011 cubic yards concrete mixed and laid	14,697.90		
Pumping	562.39		
		16,271.60	
			23,279.93
Engineering and superintendence while concrete floor construction was in progress			3,751.91
Miscellaneous:			
Repairs to Dam No. 4		766.70	
Repairs to buildings		146.59	
Expense, traveling and transportation of funds		104.31	
Expense, Montgomery office		935.40	
Engineering and superintendence		2,357.64	
Care and preservation of property		1,569.81	
General account, expenses not chargeable to any work		87.66	
			5,968.11
Lock No. 5, recording gauge			60.00
			50,827.53

CONDITION OF IMPROVEMENT AT THE CLOSE OF THE FISCAL YEAR ENDING JUNE 30, 1898.

The channel through the different bars and reefs, and, indeed, through its entire length, remains substantially the same as at the end of the last fiscal year.

RECOMMENDATIONS AND ESTIMATES.

Work has been going on in connection with this lock since 1885, when the detailed survey for the location of the lock and dam was made. The prosecution of the work has been hampered greatly by the character of the bed of the river and by the meagerness of the appropriations. The small amounts of funds doled out from time to time cause the work to be carried on in a way both wasteful and extravagant.

The amounts needed to complete work which has been begun are as follows:

Lock No. 4:	
Extension of cofferdam	$4,830.00
Repairs and addition to plant	14,000.00
Finishing concrete floor	20,000.00
Masonry of lock walls	58,647.40
Gates, valves, maneuvering machinery, etc	12,000.00
Excavation and paving below lock	15,000.00
Longitudinal dam and guide crib above lock	12,000.00
Removing cofferdam, filling behind land wall, tearing down temporary buildings, and grading yards	15,000.00
Contingencies, 10 per cent	17,647.74
Total for Lock No. 4	169,125.14

The dam of Lock No. 4 was greatly damaged during the winter of 1896–97 by logs passing over it. A large breach was made near the center. To repair this breach and raise the dam 3 feet, as approved, will cost $32,000.

The dredging and blasting in the channel between Locks 3 and 4 will cost—

At Box Shoals	$13,475
At McCoy Island Reef	1,000
At Alligator Reef	6,222
At Formby Reef	1,500
At Hunnicutt Reef	2,000
At Whiteside Bar	2,500
At Lonnergan Reef	4,000
Total for channel work	30,697

These sums added together give—

For finishing Lock No. 4	$169,125.14
For repairing and raising Dam 4	32,000.00
For channel work	30,697.00
Total	231,822.14

which amount can be expended economically and profitably during the year ending June 30, 1900.

Money statement.

July 1, 1897, balance unexpended	$39,985.50
June 30, 1898, amount expended during fiscal year	25,469.35
July 1, 1898, balance unexpended	14,516.15
July 1, 1898, outstanding liabilities	2,031.66
July 1, 1898, balance available	12,484.49

Amount (estimated) required for completion of existing project	800,133.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	231,822.14
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations.

August 14, 1876	$30,000
June 18, 1878	75,000
March 3, 1879	45,000
June 14, 1880	75,000
March 5, 1881	60,000
August 2, 1882	83,700
July 5, 1884	50,000
August 5, 1886	45,000
August 11, 1888	$60,000
September 19, 1890	150,000
July 13, 1892	130,000
August 18, 1894	110,000
June 3, 1896	50,000
Total	963,700

COMMERCIAL STATISTICS.

The following commercial statistics are reported by the White Star Line Steamboat Company, Lathrop Hatton Lumber Company, and Capt. E. Y. La Follette, of steamer *Willie C. Wagnon:*

Stern-wheel steamboat.	Registered tonnage.	Draft.		Passengers carried.	Round trips.	Between—
		Light.	Loaded.			
		Inches.	*Inches.*			
Resaca	82	16	48	2,830	69	Rome, Gadsden, Greensport, and Locks 1, 2, 3, and 4.
Connesauga	39.37	11	36	....	14	
Tony	30	12	....	....	9	
Willie C. Wagnon	151.94	16	54	291	32	

Freight carried.

Articles.		Quantity.	Tons.
Cotton	bales	13,000	3,250
Cotton seed	sacks	10,900	545
Fertilizers	do	29,200	2,920
Hides and skins	packages	200	36
Live stock	head	147	88
Lumber	feet B. M.	13,960,000	27,920
Staves		1,500,000	15,000
Provisions	packages	50,700	2,535
Grain	sacks	151,100	7,555
Miscellaneous freight	packages	85,100	8,510
Total		....	68,359

Estimated value of above freight in round numbers, $2,050,000.

2. BETWEEN WETUMKA AND EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD BRIDGE.

DESCRIPTION AND CONDITION BEFORE IMPROVEMENT.

The original condition of the part of the Coosa River between the East Tennessee, Virginia and Georgia Railroad Bridge and Wetumka, Ala., was such as to make navigation entirely impossible. The channel way was formed of a series of short, deep pools, seldom more than a mile in length, separated from each other by wide shoals, some of which are as much as 12½ miles in length.

There was no navigation existing on the river, neither had there ever been any, unless floating cotton down the river on flatboats which never returned can be called navigation. These flatboats used to go down the river to Mobile at high water. Since the construction of railways which are able to move the cotton crop to different seaports this part of the river has never been used.

During the summer and fall of 1889 a hurried survey was made of the part of the Coosa River lying between Lock 4 and Wetumka, Ala. As a result of this survey the following project was prepared:

To construct 27 locks and dams of varying lifts; to have a uniform available length of 280 feet and width of 52 feet between No. 4 and Wetumka, the last one of the series, No. 31, being at the last-named place. No lift of lock was to exceed 15 feet. In addition to these locks and dams the channel was to be cleared of various rock reefs and points. The depth of water proposed was 4 feet, so far as the channel work was concerned, and 6 feet for the locks. The total estimated cost of the work was $6,074,913.

The river and harbor act of 1890 reduced the length of the proposed locks to 210 feet between hollow quoins and the width to 40 feet. The project was modified on this basis and the total cost placed at $6,038,219.

The river and harbor act of 1892 restored the dimensions proposed originally for the locks.

OPERATIONS TO JUNE 30, 1897.

A summary of the operations on this part of the Coosa River to June 30, 1895, is given in the report of the Chief of Engineers for 1896, Part III, pages 1419, 1420.

1896.—The walls of Lock No. 31 were completed, the space between the land wall and the bank was filled in, the temporary staging and a part of the cofferdam were removed. The rock excavation in the channel above the lock was finished as far as it could be until the water shall have been backed up by the dam.

1897.—The gate anchorages and the snubbing posts, which were received at the end of 1896, were set in place and the concrete work finished around the former; the gudgeon straps and adjusting straps were fitted, marked for their respective places, and stored. The cofferdam was removed, at most points entirely, at all so far below water as to give at least a clear depth of 3 feet, and all of the timber and sheeting that could be saved was put away. Plant and tools were cleaned, repaired, and stored. The detailed survey authorized at the sites of Locks 9, 10, and 11 was begun.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1898.

The only work carried on during the fiscal year ending June 30, 1898, in connection with the improvement of this part of the Coosa River was the making of the detailed survey at and near the proposed sites of Locks Nos. 9 and 10 in accordance with the recommendation of a Board of Engineers in their report of January 30, 1897.

The survey party moved into camp on June 1, 1897, and by July 1, 1898, the work was well advanced.

The portion of the river covered by the survey for Locks Nos. 9 and 10 includes Fort William and Peckerwood Shoals, these being separated by so short a pool of navigable water—less than half a mile in length—that for the purpose of determining the location of these locks they may be considered as one continuous shoal, the head being about 10¾ miles below the East Tennessee, Virginia and Georgia Railroad bridge.

The total length of the combined shoal is about 4¾ miles, and the total fall in the low-water surface over that distance is about 13 feet.

The length of river covered by the survey was a little over 5 miles. Work was begun at the downstream end. Two base lines were laid out and very carefully measured, one at the initial point of the survey and the other near the end, the difference between the measured length of the second line and its length, calculated from the triangulation notes, being 0.811 foot, the calculated distance being the shorter.

At each of the thirty-four main triangulation stations on the right, or west, bank of the river a concrete block, approximately 18 inches by 18 inches by 30 inches, was built; a 1-inch iron bolt was set in the center of the block, with its end projecting about three-fourths of an inch above the surface. The center of the bolt was the center of the station. At five of these stations, approximately 1 mile apart, there was built into the concrete, instead of the bolt before mentioned, an iron casting having a hemispherical projection on top, center-punched for the station mark, the letters U. S. being cast on one side and the numerals 91, 92, 93, 94, and 95, respectively, on the other, these being the approximate distances in miles of these points from Montgomery by river.

All of the thirty-four stations were connected by levels, checked not less than four times by different individuals, the stations thus becoming permanent bench marks for future reference.

The stadia method was adopted for all the work on the river banks and vicinity, and a comprehensive and minutely detailed survey made within a contour line having an elevation of about 40 feet above the low-water elevation of the pool below the shoal. This elevation of 40 feet was in most places exceeded considerably, but at the upper end of the work, in the valleys of three incoming creeks or branches, it was not attained, owing to the vast extent of low lying land through which these creeks flowed and the short time remaining for field operations. When determining the location of the locks it will probably be found unnecessary to continue the stadia work any farther up those creeks.

In all about 5 square miles of country were surveyed and over 20,000 stadia observations were made.

For the work in the bed of the river range lines were staked out, crossing the river approximately at right angles and 50 feet apart throughout the whole distance of 5 miles covered. Soundings were taken about 30 feet apart on these lines and the elevation of the bottom at each point referred to the same datum as the stadia work, namely, mean tide level at Mobile. About 22,000 soundings were taken in all.

Daily gauge records were kept at various points of the work in order to determine the low-water slope, but, notwithstanding the fact that it was an exceptionally dry year, the lowest stage recorded was hardly so low as that shown on the profile of the survey of 1889.

The field work was brought to a close on November 24, 1897, the camp outfit was shipped back to Wetumka, and the party was disbanded.

Since the close of the field work the assistant engineer has been employed at Montgomery in the preparation of the maps of the survey.

It may be observed that the field work occupied nearly one month longer than would have been the case could the party have received authority to start as soon as the preparations were complete. This delay of a month allowed the crops in the bottom lands to grow so high that the stadia work in that portion occupied very much more time and trouble than would have been the case otherwise.

The cost of the field work of the survey was as follows:

Salaries	$3,558.67
Labor	2,089.93
Outfit	514.41
Provisions	661.98
Forage	115.19
Repairs	28.27
Stationery	30.00
Transportation of party	67.08
Transportation of outfit	50.00
Transportation of instruments, funds, etc	23.20
Medicine	4.45
Materials for monuments	141.91
Total	7,285.09

CONDITION OF IMPROVEMENT JUNE 30, 1898.

As the condition of the improvement has not changed since the last Annual Report, reference is made to the Report of the Chief of Engineers for 1897, Part III, page 1649.

RECOMMENDATIONS AND ESTIMATES.

An improvement of the cost and importance of that proposed for the Coosa River is such that it can be carried on with economy and efficiency only by means of large and steady appropriations. At the rate at which appropriations have been given for this river up to the present time, it will take from one hundred and fifty to two hundred years to finish the work on the approved project, which will have become antiquated long before that time, judging by the rate at which improvements have been made in transportation facilities during the last few years.

If no improvement is to be made in the present rate of work it will be much better to abandon the improvement, and I do not hesitate to recommend that it be abandoned. If it is to be continued and carried on in the way that work of such magnitude should be carried on, viz, with large and regular appropriations, $1,000,000 could be expended judiciously during the fiscal year ending June 30, 1900.

Money statement.

July 1, 1897, balance unexpended	$45,830.79
June 30, 1898, amount expended during fiscal year	10,765.51
July 1, 1898, balance unexpended	35,065.28
July 1, 1898, outstanding liabilities	213.56
July 1, 1898, balance available	34,851.72
Amount (estimated) required for completion of existing project	4,683,074.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	1,000,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations.

September 19, 1890	$150,000
July 13, 1892	100,000
August 18, 1894	110,000
June 3, 1896	50,000
Total	410,000

R II.

OPERATING AND CARE OF CANALS AND OTHER WORKS OF NAVIGATION ON COOSA RIVER, GEORGIA AND ALABAMA.

Locks Nos. 1, 2, and 3 were opened to navigation June 30, 1890, and have been operated continuously without interruption to navigation. In February, 1895, the canal between Locks Nos. 2 and 3 was frozen over for ten days, thus closing the canal to navigation during that period.

The amounts expended to the end of the fiscal year ending June 30, 1897, was $40,697.

During the fiscal year ending June 30, 1898, the following expenditures were made:

Locks Nos. 1, 2, and 3.

Date.	Voucher.	To whom paid.	For what paid.	Amount.
1897.				
July	1	Sundry persons	Pay roll	$150.00
August	1	.....do	.....do	150.00
September	1	.....do	.....do	150.00
October	1	.....do	.....do	150.00
November	1	.....do	.....do	111.67
November	2	.....do	.....do	2.00
December	1	.....do	.....do	150.00
December	2	.....do	Supplies	3.00
1898.				
January	1	.....do	Pay roll	150.00
February	1	.....do	.....do	150.00
February	2	Whit L. Davis	Lumber	5.04
March	1	Sundry persons	Pay roll	150.00
April	1	.....do	.....do	150.00
May	1	.....do	.....do	150.00
June	1	.....do	.....do	491.33
June	2	Nabers, Morrow & Sinnige	Black oil	5.61
June	3	Mattie E. Green and E. W. Green.	Services of J. F. Green (deceased).	38.33
June	4	Sundry persons	Pay roll	125.00
				2,281.98

Money statement.

July 1, 1897, balance unexpended	$187.08
July 21, 1897, amount of allotment	2,767.92
	2,955.00
June 30, 1898, amount expended during fiscal year	2,281.98
July 1, 1898, balance unexpended	673.02
July 1, 1898, outstanding liabilities	545.87
July 1, 1898, balance available	127.15

R 12.

PRELIMINARY EXAMINATION OF CHIPOLA RIVER, FLORIDA, FROM MARIANNA TO ITS CONNECTION WITH THE APALACHICOLA RIVER.

[Printed in House Doc. No. 101, Fifty-fifth Congress, second session.]

Office of the Chief of Engineers,
United States Army,
Washington, D. C., December 3, 1897.

Sir: I have the honor to submit the accompanying copy of report, dated November 11, 1897, by Maj. F. A. Mahan, Corps of Engineers, concerning a preliminary examination of Chipola River, Florida, from Marianna to its connection with the Apalachicola River, required by the provisions of the river and harbor act of June 3, 1896.

From Marianna the Chipola River flows southward a distance estimated at 65 miles to the head of the "Dead Lakes," a wide sheet of water which empties into what is known as the "Cut-off," a delta arm of the Apalachicola River. The Cut-off has been under improvement by the United States since 1890, the existing project providing for a channel 60 feet wide and 5 feet deep.

From the information now available it does not appear probable that the interests of navigation on this river are sufficient to justify such an expenditure as would be necessary for furnishing an available channel at low water, which involves the reconstruction of the fixed bridges. But inasmuch as the fact has been presented to the Chief of Engineers that a line of vessels for use on this portion of the Chipola River is now being built, such a survey as will determine the cost of work and permit a comparison between such cost and the value of improvement to commerce would appear proper.

Very respectfully, your obedient servant,

John M. Wilson,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. Alger,
Secretary of War.

REPORT OF MAJ. F. A. MAHAN, CORPS OF ENGINEERS.

United States Engineer Office,
Montgomery, Ala., November 11, 1897.

General: I have to submit the following report on the Chipola River, Florida, between Marianna and the mouth.

This stream rises in southeastern Alabama and empties into the Apalachicola River about 40 miles above the mouth of the latter.

From Marianna the Chipola River flows southward a distance estimated at 65 miles to the head of the "Dead Lakes," a wide sheet of water which empties into what is known as the "Cut-off," a sort of delta arm of the Apalachicola River, which it leaves at a point about 5 miles below Iola, and which it rejoins some 20 miles farther downstream. The Cut-off is divided into three sections—the Cut-off proper, being about one-half of the total length; Lees Slough, the next section below, about one-fourth, and Lower Chipola River, the last section, about one-fourth.

The Cut-off, Lees Slough, and the Lower Chipola River have been under improvement since 1890, when the first appropriation was made for this work. This part of the stream was deemed worthy of improvement as being the outlet for an important commerce centering at the town of Wewahitchka.

The length of the river, 65 miles, from Marianna to the head of the Dead Lakes has a general low-water depth of 5 feet, with a width varying from 60 to 200 feet. It is much obstructed, naturally, by shoals, snags, and overhanging trees. The shoals are of rock. They are distant 23, 29, 32, 36, 37, and 45 miles (estimated distances) below Marianna. Three bridges—a road bridge at Marianna, a railroad bridge 2 miles below, and a road bridge 14 miles below—are obstructions, with headways 17, 16, and 15 feet, respectively, above low water.

The channel through the Dead Lakes is tortuous. It was much obstructed by logs and snags at the time of an examination made in 1888. As no attempt at improvement has been made, it is likely that the state of the channel is worse in this respect than it was nine years ago.

On account of the improbability of much present use of the river above the Cut-off by boats, even if cleared out, and on account of the existence of bridges without draws, which would prevent effectually any boats reaching Marianna, I do not consider the part of this river from Marianna to the Cut-off as worthy of improvement, at the present time at least; therefore I make no recommendation for a survey or for an appropriation looking toward improvement.

Very respectfully, your obedient servant,

F. A. MAHAN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

APPENDIX S.

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI, AND OF BOGUE CHITTO, LOUISIANA.

REPORT OF MAJ. WM. T. ROSSELL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Mobile Harbor, Alabama.
2. Black Warrior River, Alabama, from Tuscaloosa to Daniels Creek.
3. Operating and care of locks and dams on Black Warrior River, Alabama.
4. Warrior and Tombigbee rivers, Alabama and Mississippi.
5. Noxubee River, Mississippi.
6. Pascagoula River, Mississippi.
7. Chickasahay River, Mississippi.
8. Leaf River, Mississippi.
9. Pearl River below Jackson, Mississippi.
10. Pearl River between Carthage and Jackson, Mississippi.
11. Pearl River between Edinburg and Carthage, Mississippi.
12. Bogue Chitto, Louisiana.
13. Survey for canal from Birmingham, Alabama, to the Warrior River.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., July 20, 1898.

GENERAL: I have the honor to forward herewith annual report * * * for the fiscal year ending June 30, 1898, for the works of rivers and harbors under my charge.

* * * * * * *

Very respectfully, your obedient servant,

WM. T. ROSSELL,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

S 1.

IMPROVEMENT OF HARBOR AT MOBILE, ALABAMA.

ORIGINAL CONDITION OF WORK.

For original condition of this work see pages 1425 and 1426, Annual Report of 1896.

For maps of Mobile Bay from 1764 to 1820 see page 1432, Annual Report of 1896.

PLAN OF IMPROVEMENT.

The present plan of improvement is for maintenance of the channel by dredging.

WORK PRIOR TO JUNE 30, 1897.

For work prior to June 30, 1897, see pages 1662, 1663, 1664, 1665, and 1666, Annual Report for 1897.

WORK OF THE PAST YEAR.

Work under the act of June 3, 1896, appropriating $60,000 for the maintenance of the channel by dredging was continued.

The contractors were the National Dredging Company, of Wilmington, Del., who, by the terms of their contract, dated December 28, 1896, hired to the Government the dredging plant consisting of the dredge *Chas. Fobes*, steam tug *Mary B. Curtis*, three scows, and the coal sloop *Captain Ben*, at the rate of $230 per day of eight hours, the contractor guaranteeing to remove 2,875 cubic yards per day.

Work was discontinued on September 20, 1897, on account of quarantine regulations, necessitated by an epidemic of fever. At this date the dredge had reached a point 186 feet south of Station 39, being an advance of 6,743 feet from the point reached at the termination of last fiscal year, viz, 1,347 feet south of Station 36.

On March 4, 1898, work was resumed under the same appropriation and contract, the location of the dredge being changed to Station 47, the channel having shoaled considerably at that point. On March 11, 1898, the funds of the appropriation of June 3, 1896, were exhausted. The dredge had reached a point 712 feet south of Station 47.

From July 1, 1897, to March 11, 1898, the contractors removed 220,014 cubic yards of material in 74½ days of 8 hours, and the daily average of removal was 2,953 cubic yards.

On June 4, 1897, an appropriation of $25,000 was made for maintaining channel in Mobile Harbor, Alabama. Invitations to bidders were advertised on January 17, 1898, and the bids were opened February 15, 1898.

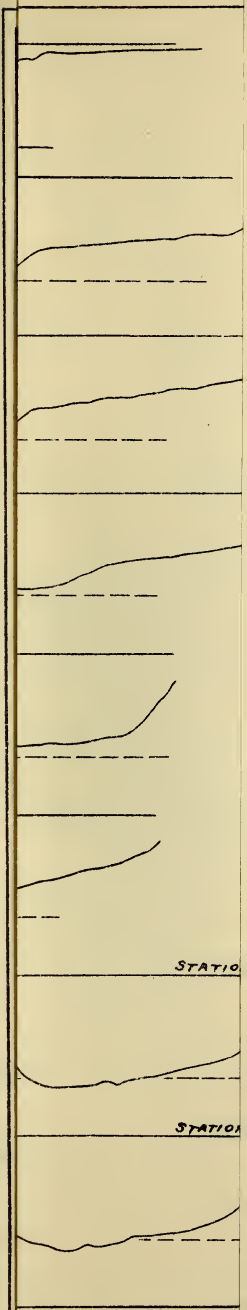
The contract was awarded to the National Dredging Company on February 26, 1898, and as the terms and conditions were the same as in the previous contract there was no interruption whatever in the work on the channel, and the dredging continued until June 21, 1898, when, by limitation of contract, the funds being exhausted, work was discontinued.

Under the appropriation of June 4, 1897, the dredge progressed from a point 712 feet south of Station 47 to 696 feet south of Station 50, being a distance of 7,904 feet. The contractors, in 83½ working days, removed 243,996 cubic yards of material, making a daily average of 2,922 cubic yards. The material is very soft to slightly stiff mud mixed with a little decayed shell. Two cuts, each 40 feet wide, have been dredged to a depth not less than 23 feet at mean low water.

During the past year the U. S. S. *Maud* has removed all deadheads discovered in the channel.

Two maps are inclosed herewith showing present condition of dredged channel.

The total amount expended on this improvement to June 30, 1898, is $2,237,860.70.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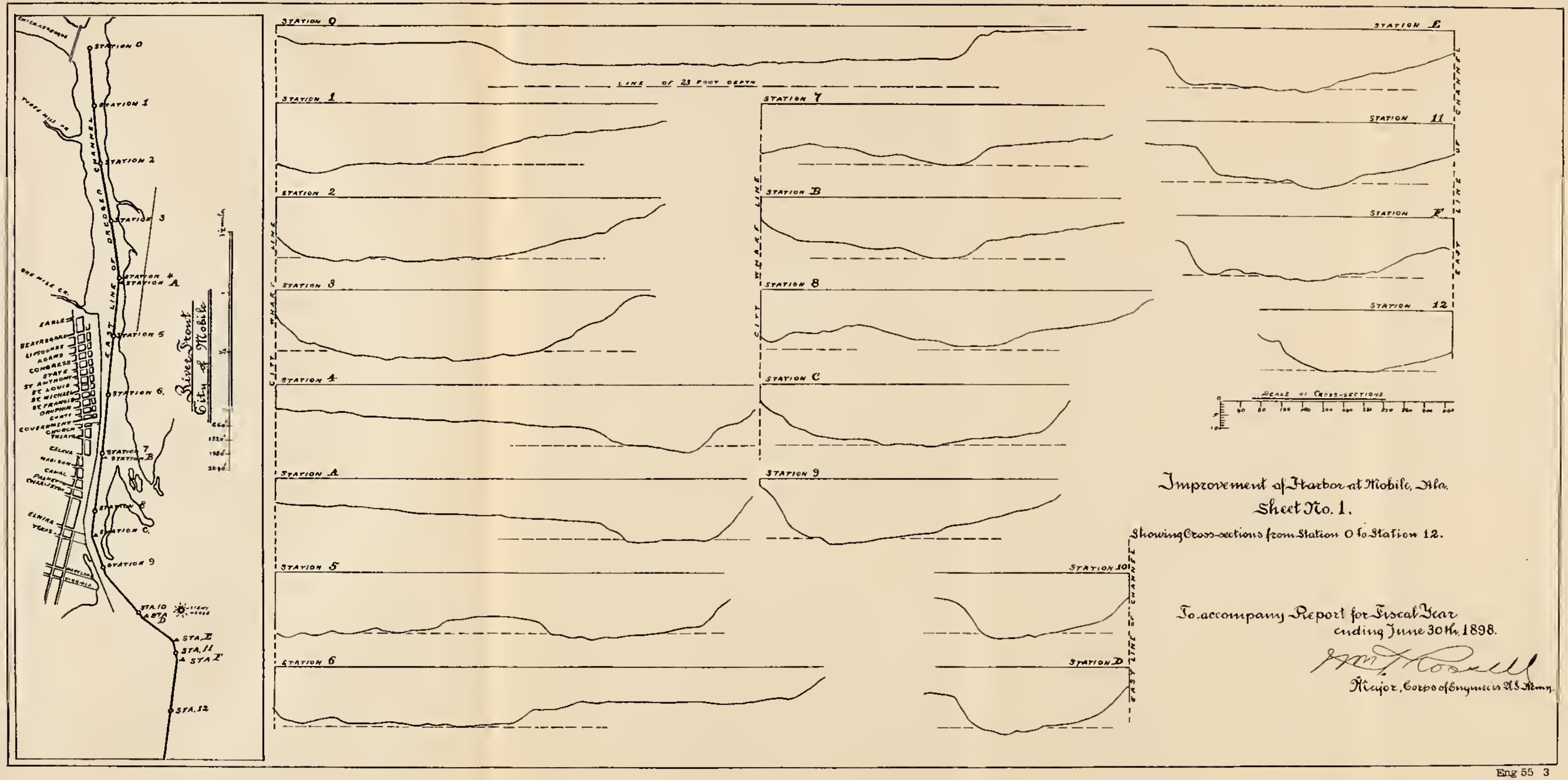


Improvement of Harbor at Mobile, Ala.

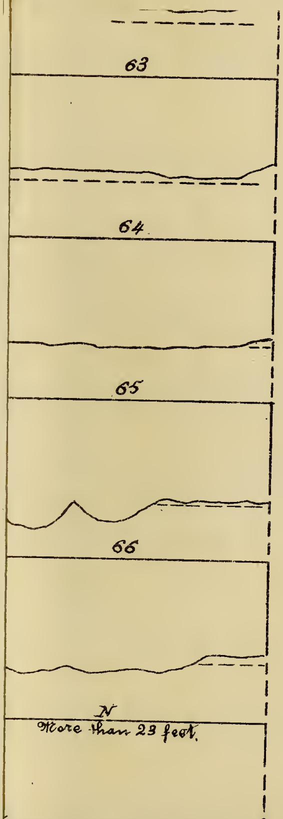
Sheet No. 1.

Showing Cross-sections from Station 0 to Station 12.

To accompany Report for Fiscal Year ending June 30th, 1898.

Wm. T. Rossell

Major, Corps of Engineers U.S. Army.



mprovement of Harbor at Mobile, Ala.

—Sheet No. 2.—

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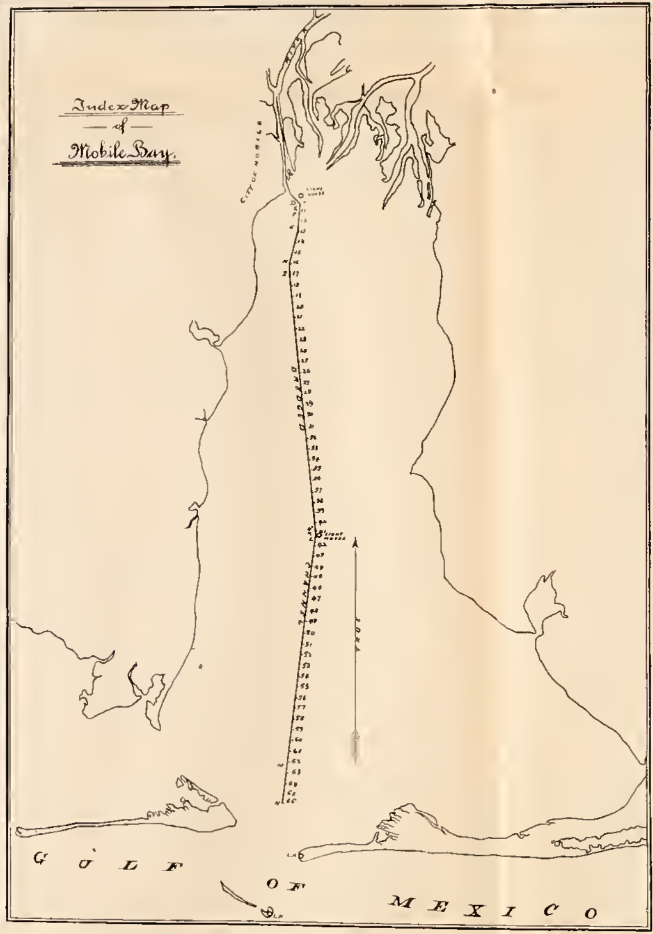
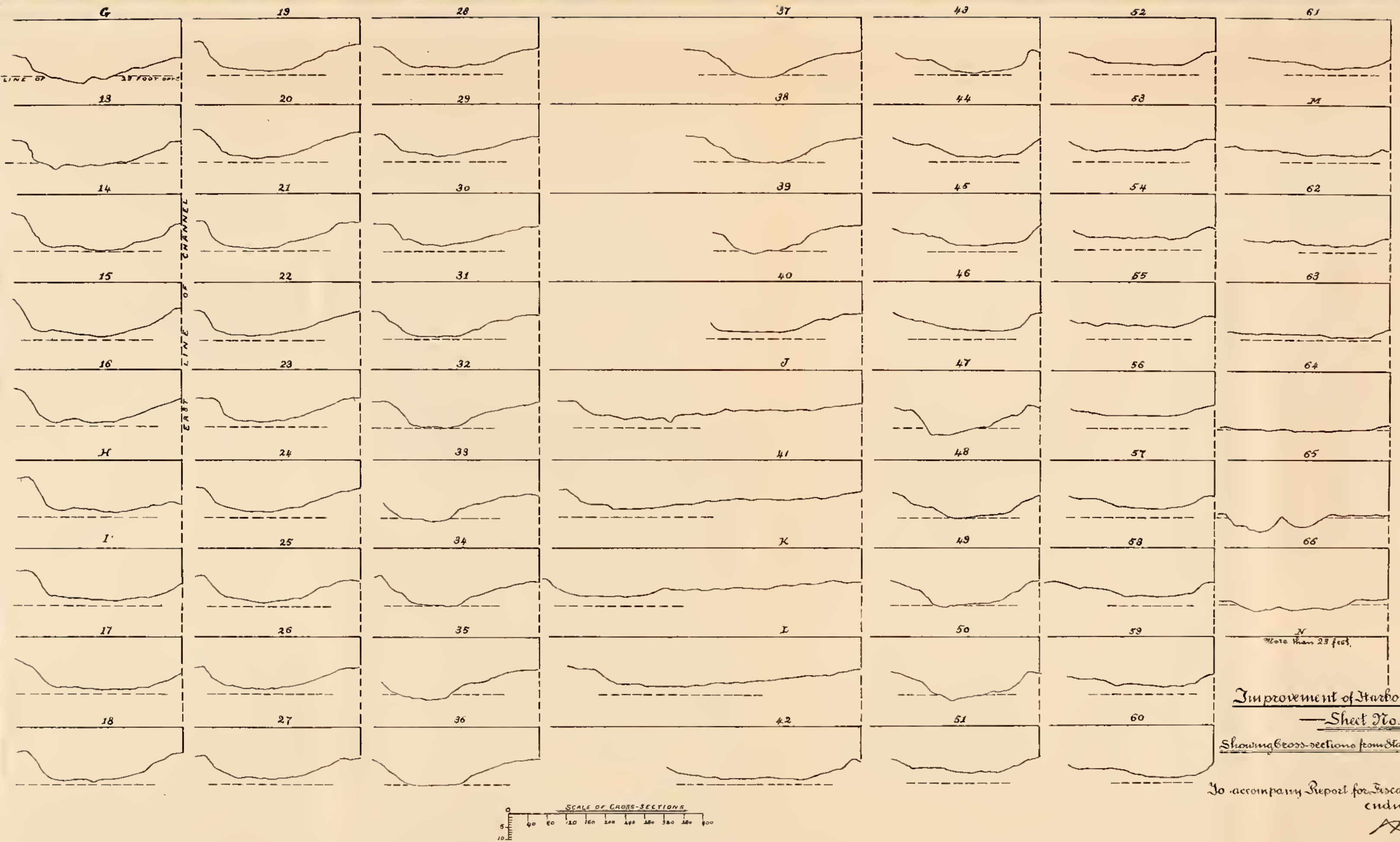
ending June 30th, 1898.

Wm. T. Rossell
Major Corps of Engineers. U.S. Army.





Improvement of Harbor at Mobile, Ala.

—Sheet No. 2.—

Showing Cross-sections from Station G to end of Channel.

To accompany Report for Fiscal Year
ending June 30th, 1898.

Wm. T. Rossell
Major, Corps of Engineers, U.S. Army.

Tabular statement showing the channel as dredged and its condition on June 30, 1898.

Locality.	Dredged.		Examinations.						
	Width.	Central depth.	Cross section at—	Distance between stations.	Top width.	Maximum depth in cross section.			
						June, 1891.	June, 1896.	June, 1897.	June, 1898.
	Feet.	*Feet.*		*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Station 0	....	....	Initial point at mouth of Chickasabogue Creek.	....	1,550	15.9	15.6	15.7	15.3
			South of initial point.						
Station 0 to 1	....	....	0.50 mile	2,640	950	23.0	24.5	27.1	26.8
Station 1 to 2	....	....	1.00 mile	2,640	750	21.3	24.3	26.7	24.5
Station 2 to 3	....	....	1.50 miles	2,640	800	21.3	27.8	26.2	27.1
Station 3 to 4	120	23–24	2.00 miles	2,640	1,060	18.9	25.1	26.0	26.1
Station 4 to A	120	23–24	2.03 miles	200	1,070	18.9	24.8	24.2	24.3
Station A to 5	120	23–24	2.50 miles	2,440	960	21.3	24.4	25.7	25.5
Station 5 to 6	120	23–24	3.00 miles	2,640	1,035	16.7	24.2	23.4	22.9
Station 6 to 7	160	23–24	3.50 miles	2,640	910	16.5	23.4	23.1	23.1
Station 7 to B	80	23–24	3.54 miles	240	890	17.1	23.4	23.3	23.2
Station B to 8	80	23–24	4.00 miles	2,400	720	16.4	22.3	22.7	21.8
Station 8 to C	80	23–24	4.21 miles	1,210	700	19.7	23.5	23.7	23.5
Station C to 9	80	23–24	4.50 miles	1,430	570+	21.3	27.7	25.8	25.1
Station 9 to 10	240	23–24	5.00 miles	2,640	700	19.7	27.8	25.3	25.2
Station 10 to D	240	23–24	5.04 miles	245	700	17.6	26.5	25.9	25.7
Station D to E	475	23–24	5.35 miles	1,650	700	19.6	27.0	25.8	24.1
Station E to 11	475	23–24	5.50 miles	745	700	19.9	26.1	25.7	25.4
Station 11 to F	475	23–24	5.54 miles	233	700	19.9	26.9	25.6	24.8
Station F to 12	280	23–24	6.00 miles	2,407	700	21.3	24.8	24.5	23.3
Station 12 to G	280	23–24	6.38 miles	2,034	700	18.3	27.9	26.4	26.4
Station G to 13	280	23–24	6.50 miles	606	700	18.8	27.2	25.3	25.2
Station 13 to 14	280	23–24	7.00 miles	2,640	700	24.5	24.1	23.4	22.5
Station 14 to 15	280	23–24	7.50 miles	2,640	700+	24.5	24.1	22.4	21.8
Station 15 to 16	280	23–24	8.00 miles	2,640	700+	26.3	25.1	22.7	21.0
Station 16 to H	280	23–24	8.07 miles	404	700+	26.3	24.5	22.1	21.1
Station H to I	340	23–24	8.49 miles	2,228	700+	24.8	25.0	22.5	21.0
Station I to 17	340	23–24	8.50 miles	8	700+	24.8	25.0	22.5	21.2
Station 17 to 18	280	23–24	9.00 miles	2,640	700+	21.8	25.2	21.8	21.9
Station 18 to 19	280	23–24	9.50 miles	2,640	700+	25.0	27.9	22.5	21.2
Station 19 to 20	280	23–24	10.00 miles	2,640	700+	26.3	25.2	22.6	21.4
Station 20 to 21	280	23–24	10.50 miles	2,640	700+	16.9	27.6	22.6	22.0
Station 21 to 22	280	23–24	11.00 miles	2,640	700+	16.7	24.6	21.9	21.2
Station 22 to 23	280	23–24	11.50 miles	2,640	700+	16.1	23.0	21.1	21.1
Station 23 to 24	280	23–24	12.00 miles	2,640	700+	16.5	23.0	20.8	20.6
Station 24 to 25	280	23–24	12.50 miles	2,640	700+	16.4	24.9	21.4	21.5
Station 25 to 26	280	23–24	13.00 miles	2,640	700+	16.4	23.9	20.8	21.1
Station 26 to 27	280	23–24	13.50 miles	2,640	700+	16.2	24.3	21.6	20.8
Station 27 to 28	280	23–24	14.00 miles	2,640	700+	17.9	25.8	21.6	20.2
Station 28 to 29	280	23–24	14.50 miles	2,640	700+	16.1	25.3	20.6	20.9
Station 29 to 30	280	23–24	15.00 miles	2,640	700+	16.2	24.5	21.6	20.7
Station 30 to 31	280	23–24	15.50 miles	2,640	700+	16.3	22.8	27.5	21.8
Station 31 to 32	280	23–24	16.00 miles	2,640	700+	16.5	22.9	28.8	22.8
Station 32 to 33	280	23–24	16.50 miles	2,640	700+	16.1	23.2	26.9	24.2
Station 33 to 34	280	23–24	17.00 miles	2,640	700+	16.1	23.0	27.7	23.0
Station 34 to 35	280	23–24	17.50 miles	2,640	700+	15.5	23.0	27.0	25.2
Station 35 to 36	280	23–24	18.00 miles	2,640	700+	15.7	23.4	27.6	23.1
Station 36 to 37	280	23–24	18.50 miles	2,640	700+	15.4	24.3	19.5	24.0
Station 37 to 38	280	23–24	19.00 miles	2,640	700+	15.5	23.5	20.1	23.2
Station 38 to 39	280	23–24	19.50 miles	2,640	700+	15.3	24.5	20.0	24.2
Station 39 to 40	280	23–24	20.00 miles	2,640	700+	15.4	24.5	20.4	20.5
Station 40 to J	280	23–24	20.47 miles	2,471	700+	15.0	24.0	21.0	20.8
Station J to 41	500	23–24	20.50 miles	169	700+	15.0	23.2	22.0	20.0
Station 41 to K	500	23–24	20.63 miles	671	700+	15.0	23.0	22.8	19.4
Station K to L	500	23–24	20.80 miles	918	700+	14.6	22.4	22.2	19.7
Station L to 42	280	23–24	21.00 miles	1,051	700+	14.6	25.6	25.0	20.9
Station 42 to 43	280	23–24	21.50 miles	2,640	700+	14.7	26.0	23.0	21.9
Station 43 to 44	280	23–24	22.00 miles	2,640	700+	14.3	26.0	21.9	21.4
Station 44 to 45	280	23–24	22.50 miles	2,640	700+	18.4	25.6	20.8	20.5
Station 45 to 46	280	23–24	23.00 miles	2,640	700+	22.0	27.4	20.7	19.7
Station 46 to 47	280	23–24	23.50 miles	2,640	700+	22.8	24.6	20.0	25.8
Station 47 to 48	280	23–24	24.00 miles	2,640	700+	21.5	27.6	19.5	23.3
Station 48 to 49	280	23–24	24.50 miles	2,640	700+	21.6	25.3	19.5	23.7
Station 49 to 50	280	23–24	25.00 miles	2,640	700+	21.5	23.9	19.5	25.2
Station 50 to 51	280	23–24	25.50 miles	2,640	700+	19.0	24.8	19.4	18.9
Station 51 to 52	280	23–24	26.00 miles	2,640	700+	18.0	26.0	20.0	19.1
Station 52 to 53	280	23–24	26.50 miles	2,640	700+	13.0	26.4	19.7	18.6
Station 53 to 54	280	23–24	27.00 miles	2,640	700+	13.2	23.6	19.7	19.0
Station 54 to 55	280	23–24	27.50 miles	2.640	700+	13.7	26.7	19.8	18.3

Tabular statement showing the channel as dredged and its condition on June 30, 1898—Continued.

Locality.	Dredged.		Examinations.						
						Maximum depth in cross section.			
	Width.	Central depth.	Cross section at—	Distance between stations.	Top width.	June, 1891.	June, 1896.	June, 1897.	June, 1898.
			South of initial point—continued						
	Feet.	*Feet.*		*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Station 55 to 56	280	23–24	28.00 miles	2,640	700+	13.7	25.3	20.3	18.0
Station 56 to 57	280	23–24	28.50 miles	2,640	700+	14.4	23.6	20.3	19.5
Station 57 to 58	280	23–24	29.00 miles	2,640	700+	14.4	21.9	20.7	19.4
Station 58 to 59	280	23–24	29.50 miles	2,640	700+	14.4	21.3	22.4	19.8
Station 59 to 60	280	23–24	30.00 miles	2,640	700+	15.3	21.6	23.0	21.2
Station 60 to 61	280	23–24	30.50 miles	2,640	700+	16.1	21.3	23.1	20.4
Station 61 to M	280	23–24	30.81 miles	1,659	700+	16.1	21.4	23.1	20.7
Station M to 62	200	23–24	31.00 miles	981	700+	16.2	22.9	23.2	20.6
Station 62 to 63	200	23–24	31.50 miles	2,640	700+	23.2	23.9	26.2	21.9
Station 63 to 64	200	23–24	32.00 miles	2,640	700+	22.3	27.9	24.9	24.1
Station 64 to 65	200	23–24	32.50 miles	2,640	350	21.0	29.4	28.6	28.8
Station 65 to 66	200	23–24	33.00 miles	2,640	370	22.9	26.8	26.8	25.2
Station 66 to N	200	23–24	33.08 miles	459	390	23.1	25.9	25.8	25.8

	Miles.
Less than 23 feet at mean low water	20½
Less than 22 feet at mean low water	18
Less than 21 feet at mean low water	10
Less than 20 feet at mean low water	4

Money statement.

July 1, 1897, balance unexpended	$55,638.68
June 30, 1898, amount expended during fiscal year	54,699.38
	939.30
July 1, 1898, balance unexpended	939.30
July 1, 1898, outstanding liabilities	31.80
July 1, 1898, balance available	907.50
Amount (estimated) required for completion of existing project (maintenance)	300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900 (maintenance)	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Work was first done on the channel leading to the wharves at Mobile by the General Government in 1827.

The following appropriations were made by Congress:

May 20, 1826	$10,000.00
March 2, 1829	20,000.00
June 24, 1834	10,000.00
March 3, 1835	17,997.60
March 3, 1837	50,000.00
July 7, 1838	50,000.00
August 3, 1852	50,000.00
	207,997.60
March 3, 1857 (relief claim)	20,833.08
Total	228,830.68

The second stage of improvement was entered upon in 1870. This project was finished in 1876, under the following appropriations:

By act of Congress—	
July 11, 1870	$50,000
March 3, 1871	50,000
June 10, 1872	75,000
March 3, 1873	100,000
June 23, 1874	100,000
March 3, 1875	26,000
Total	401,000

In the third stage of improvement work was done under appropriations as follows:

June 18, 1878 (survey)	$10,000
March 3, 1879	100,000
June 14, 1880	125,000
March 3, 1881	100,000
August 2, 1882	125,000
July 5, 1884	200,000
August 6, 1886	90,000
Total	750,000

The fourth stage of this work was begun in 1888 and has been completed.

Appropriations have been made as follows:

By act of Congress—	
August 11, 1888	$250,000
September 19, 1890	350,000
July 13, 1892	212,500
Sundry civil act, March 3, 1893	500,000
Sundry civil act, August 18, 1894	390,000
Sundry civil act, March 2, 1895	291,300
March 16, 1896	160,000
June 3, 1896	60,000
June 4, 1897	25,000
Total	2,238,800

Abstract of proposals for hire of dredging plant for Mobile River and Bay, Alabama.

No.	Name and place of residence of bidders.	Hire of dredging plant.	To remove each day of 8 hours— Below Station 24.	To remove each day of 8 hours— Above Station 24.
1	National Dredging Co., Wilmington, Del.	$230 per day	2,875 cu. yds	300 to 1,000 cu. yds.
2	Rittenhouse Moore Dredging Co., Mobile, Ala.	$235 per day	2,600 cu. yds	300 cu. yds.

Recommended for acceptance, bid No. 1, National Dredging Company, at $230 per day, removing 2,875 cubic yards per day below Station 24 and 300 to 1,000 cubic yards per day above Station 24.

COMMERCIAL STATISTICS.

Comparative statement of lumber, cotton, etc., shipped to foreign and coastwise ports.

[Compiled from records of Mobile Cotton Exchange.]

Articles.	1898.	1897.	1896.	1895.
Lumber ....tons..	76,079	106,095	88,045	83,557
Timber ....do...	97,765	191,772	129,021	144,737
Shingles ....do...	107	299	185	825
Staves ....do...	2,323	167	....	....
Cotton ....do...	86,550	76,847	52,090	29,941

Comparative statement of the number and draft of vessels passing up and down the dredged channel.

[Compiled from the books of the harbor master.]

Draft in feet.	Steamships.				Square-rigged vessels.				Schooners.				Total.			
	Up.		Down.		Up.		Down.		Up.		Down.		Up.		Down.	
	1898.	1897.	1898.	1897.	1898.	1897.	1898.	1897.	1898.	1897.	1898.	1897.	1898.	1897.	1898.	1897.
Less than 13 ...	206	180	126	87	54	84	3	2	40	79	22	18	300	343	151	107
13 to 14	41	72	31	25	28	40	1	5	.....	.....	7	7	69	112	39	37
14 to 15	29	20	27	33	17	21	13	7	.....	1	5	13	46	42	45	53
15 to 16	14	8	28	19	10	11	4	4	.....	.....	.....	8	24	19	32	31
16 to 17	12	7	24	9	1	6	3	14	.....	.....	.....	16	13	13	27	39
17 to 18	3	1	10	14	1	3	9	12	.....	.....	.....	9	4	4	19	35
18 to 19	1	2	7	41	.....	3	9	10	.....	.....	.....	.....	1	5	16	51
19 to 20	.....	.....	13	8	1	.....	10	19	.....	.....	.....	4	1	.....	23	31
20 to 21	.....	.....	14	10	.....	1	19	13	.....	.....	.....	1	.....	1	33	24
21 to 22	1	.....	10	16	.....	1	15	30	.....	.....	.....	.....	1	1	25	46
22 to 23	.....	.....	14	17	.....	.....	21	25	.....	.....	.....	.....	.....	.....	35	42
23	.....	.....	3	5	.....	.....	10	15	.....	.....	.....	.....	.....	.....	13	20
Total	307	290	307	284	112	170	117	156	40	80	34	76	459	540	458	516

NOTE.—Very many schooners ascending the channel on a less draft than 13 feet are not noted in the records of the harbor master, and therefore do not appear in this statement.

S 2.

IMPROVEMENT OF BLACK WARRIOR RIVER, ALABAMA, FROM TUSCALOOSA TO DANIELS CREEK.

The character and cost of previous work on this improvement is fully discussed on pages 1669–1674, Annual Report of Chief of Engineers, United States Army, for 1897.

During the past fiscal year the gauge at proposed Lock No. 4 was read daily at 7 a. m.

During July, 1897, a telephone line was built and equipped from the United States Engineer Office in Tuscaloosa to Locks 1, 2, and 3, at a cost of $279.69 for about 2 miles of line and 4 instruments.

During May, 1898, the last 4 derricks which remained standing on Lock No. 1 stone yard were taken down, and the crabs and other machinery belonging to them were stored under shelter. The timbers of the derricks had become rotten and they were taken down to prevent their falling.

The total amount expended on this improvement to June 30, 1898, is $600,256.65.

Money statement.

July 1, 1897, balance unexpended	$20,002.24
June 30, 1898, amount expended during fiscal year	16,508.89
July 1, 1898, balance unexpended	3,493.35
July 1, 1898, outstanding liabilities	36.53
July 1, 1898, balance available	3,456.82
Amount (estimated) required for completion of existing project	190,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	190,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
July 5, 1884	$50,000
August 1, 1886	56,250
August 11, 1888	100,000
September 19, 1890	150,000
July 13, 1892	200,000
August 18, 1894	37,500
June 3, 1896	10,000
Total	603,750

COMMERCIAL STATISTICS.

In addition to the commerce reported elsewhere as passing through the locks, the following commerce on Pool No. 3 stopped at White's landing above the locks:

Coal	785 tons.
Cross ties	4,700 tons.
Logs	5,600 tons.
Total	11,085 tons.

S 3.

OPERATING AND CARE OF LOCKS AND DAMS ON BLACK WARRIOR RIVER, ALABAMA.

The three locks were operated and cared for by two lock hands at each lock, under the general supervision of the lock master, without interruption during the year.

During a period of extreme low water in September and October, 1897, the levels of the pools were lowered by leakage and frequent lockages below the crests of dams. Pool No. 1 was thus reduced 2.70 feet below crest of dam; Pool No. 2, 3.20 feet, and Pool No. 3, 1.62 feet. On October 1 the lock master, with the regular lock hands, a small force of extra laborers, and the use of a barge, began filling above the dams with spalls, gravel, sand, clay, and cinders, to reduce leakage. By October 22 all the pools were full, with water running over the crests of dams, and on October 30 filling was discontinued for the season. The cost of filling may be itemized as follows:

Designation.	Quantity.	Cost.	Rate per unit.
Filling above Dam No. 1 ....cubic yards..	310	$136.25	$0.44
Filling above Dam No. 2 ....do.....	135	58.37	.43
Filling above Dam No. 3 ....do.....	140	35.63	.25½
Total	585	230.25	.39⅓

During October the miter sills at lower end of Lock No. 1 were lined with thin strips of sheet lead, to reduce leakage between the sills and gates.

During December and January the lock master, with the regular lock hands and small force of extra laborers, removed obstructions from approaches to the locks and repaired bank protection below Abutments 1 and 3. The cost of these repairs may be itemized as follows:

Designation.		Quantity.	Cost.	Rate per unit.
Riprap below Abutment No. 1	cubic yards	13	$9.50	$0.73
Riprap below Abutment No. 2	do	96	63.62	.66
Total		109	73.12	.67

During February 8 cubic yards of riprap were placed by the regular lock hands to repair bank protection below Abutment No. 2.

Several face stones at Dam No. 3 were hammered out of place by saw logs in the backlash during the winter floods and will be replaced this summer. No other damage has occurred. Materials for fencing in United States land at Locks 1 and 3 have been contracted for and partly delivered. A carpenter with a small force, assisted by the regular lock hands, is now building the fence at Lock No. 1, and will afterwards build the fence at Lock No. 3.

Itemized statement of expenditures during the fiscal year ending June 30, 1898.

Date.	To whom paid.	For what paid.	Amount.
1897.			
Aug. 11	Sundry persons	Pay roll for July, 1897	$305.00
Sept. 6	do	Pay roll for August, 1897	290.67
Sept. 20	Marshall & Bruce Co	Printing	83.00
Sept. 20	R. P. Prowell	Maintenance of telephones	4.00
Oct. 8	Sundry persons	Pay roll for September, 1897	318.40
Nov. 2	R. P. Prowell	Maintenance of telephones	4.00
Nov. 4	Sundry persons	Pay roll for October, 1897	574.50
Nov. 30	R. P. Prowell	Maintenance of telephones	4.00
Dec. 6	Sundry persons	Pay roll for November, 1897	304.50
Dec. 15	Allen & Jemison Co	Lead	9.00
Dec. 15	R. P. Prowell	Maintenance of telephones	4.00
1898.			
Jan. 5	Sundry persons	Pay roll for December, 1897	307.25
Jan. 5	do	do	36.49
Jan. 11	R. P. Prowell	Maintenance of telephones	4.00
Jan. 11	Jno. T. Cochrane	Hauling	.25
Jan. 25	Sundry persons	Pay roll for December, 1897	5.87
Feb. 3	do	Pay roll for January, 1898	16.50
Feb. 4	do	do	335.00
Feb. 10	Tuscaloosa Telephone Exchange	Maintenance of telephones	4.00
Mar. 7	Sundry persons	Pay roll for February, 1898	305.00
Mar. 14	Tuscaloosa Telephone Exchange	Maintenance of telephones	4.00
Apr. 6	Sundry persons	Pay roll for March, 1898	305.00
Apr. 12	Tuscaloosa Telephone Exchange	Maintenance of telephones	4.00
Apr. 12	Evins Hill	Hauling	.50
Apr. 26	Jno. T. Cochrane	Oil, etc	6.50
Apr. 27	Tuscaloosa Telephone Exchange	Maintenance of telephones	4.00
May 4	Sundry persons	Pay roll for April, 1898	305.00
May 24	Tuscaloosa Telephone Exchange	Maintenance of telephones	4.00
May 24	Jno. T. Cochrane	Hauling	.50
June 2	Sundry persons	Pay roll for May, 1898	305.00
June 4	Andrew J. Morse & Son	Diving apparatus	516.00
June 25	Jno. T. Cochrane	Oil	6.13
June 25	Allen & Jemison Co	Hardware	70.70
June 29	Tuscaloosa Telephone Exchange	Maintenance of telephones	4.00
June 30	Sundry persons	Pay roll for June, 1898	331.25
	Total		4,782.01

The following is a statement of expenditures for operating and care of canals, Black Warrior River, Alabama, during fiscal year ending June 30, 1898, submitted in accordance with Circular No. 12 from Office of the Chief of Engineers, United States Army, dated Washington, D. C., July 31, 1897:

Items.	Allotment.	Expended.	Balance.
Salaries, lock hands	$3, 660. 00	$3, 624. 17	$35. 83
Filling above dams	500. 00	230. 25	269. 75
Riprap bank protection	1, 000. 00	73. 12	926. 88
Fuel, oil, lights	150. 00	13. 13	136. 87
Tools	100. 00	12. 65	87. 35
Repair gates and valves	90. 00	57. 00	33. 00
Diving apparatus	574. 00	516. 50	57. 50
Fencing Locks 1, 2, and 3	750. 00	96. 95	653. 05
Telephone service	....	48. 00	48. 00
Stationery	....	83. 25	83. 25
Incidentals	....	26. 99	26. 99
Total	6, 824. 00	4, 782. 01	2, 041. 99

Money statement.

July 1, 1897, balance unexpended	$270. 57
Amount allotted during fiscal year	6, 553. 43
	6, 824. 00
June 30, 1898, amount expended during fiscal year	4, 782. 01
July 1, 1898, balance unexpended	2, 041. 99
July 1, 1898, outstanding liabilities	192. 21
July 1, 1898, balance available	1, 849. 78

COMMERCIAL STATISTICS.

Traffic.

Vessels.	Lock No. 1.			Lock No. 2.			Lock No. 3.		
	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.	Ascending.	Descending.	Total.
Towboats	110	112	222	318	316	634	316	320	636
Government boats	6	5	11	....	....	......	....	....	......
Coal barges	11	17	28	72	81	153	83	96	179
Other barges	156	160	316	136	135	271	136	136	272
Government barges	33	26	59	8	7	15	12	11	23
Government small craft	37	43	80	29	29	58	23	25	48
Small craft	43	39	82	29	34	63	41	35	76
Rafts	1	55	56	3	57	60	7	57	64
Total	397	457	854	595	659	1, 254	618	680	1, 298
Passengers	129	74	203	1, 595	1, 352	2, 947	1, 668	1, 421	3, 089
Lockages	259	278	537	367	407	774	386	429	815

Commerce.

[In tons.]

Lock.	Date.	Coal.	Corn.	Steel rails.	Cement.	Stone.	Tools and implements.	Posts.	Cross-ties.	Hewn timbers.	Logs.	Lumber.	Sand.	General and miscellaneous.	Totals.
No. 1	July, 1897	33.5	....	....	....	......	....	....	....	230	....	4	....	6	273.5
	August, 1897	20	....	....	....	350	....	....	....	226	....	.....	....	70	666
	September, 1897	....	....	....	....	962	....	....	....	445	....	.....	....	......	1,407
	October, 1897	46.5	....	....	....	1,983	....	....	....	1,434	....	.....	....	......	3,463.5
	November, 1897	27	....	....	....	1,513	....	....	....	2,160	....	324	....	7.5	4,031.5
	December, 1897	14	....	....	....	155	....	....	113	499	....	24	....	9.5	814.5
	January, 1898	370	....	....	....	105	....	....	....	......	....	.....	60	......	535
	February, 1898	437	....	....	....	8	....	....	....	......	....	.....	88	......	533
	March, 1898	1,245	....	....	....	......	....	....	....	......	....	.....	....	18	1,263
	April, 1898	30	....	....	....	......	....	....	....	270	....	.....	....	......	300
	May, 1898	....	....	....	....	......	....	....	....	......	....	.....	....	......	....
	June, 1898	....	....	....	....	......	....	....	....	......	4	.....	....	......	4
	Total	2,223	....	....	....	5,076	....	....	113	5,264	4	352	148	111	13,291
No. 2	July, 1897	195.5	....	....	....	......	....	....	....	258	....	4.5	....	16.25	474.25
	August, 1897	154	....	....	....	350	....	....	....	284	....	.....	....	100.25	888.25
	September, 1897	180.25	....	....	....	1,100	....	....	....	622	....	.....	....	32.25	1,934.50
	October, 1897	195.5	....	....	....	2,010	....	....	....	1,434	....	.....	....	2	3,641.50
	November, 1897	357	....	....	....	1,490	....	....	....	2,160	....	324	....	9.5	4,540.50
	December, 1897	134	....	....	....	155	....	....	113	499	....	24	....	39	964
	January, 1898	523	....	....	....	105	....	....	....	......	....	.....	60	11	699
	February, 1898	562	25	15	9.5	......	....	6	....	......	....	.....	88	2	707.50
	March, 1898	1,395	....	7	....	......	15	....	....	......	....	36	....	30	1,483
	April, 1898	55	....	....	....	......	....	....	....	270	....	76	....	50	451
	May, 1898	103	....	....	....	......	....	....	....	......	12	.....	....	6.75	121.75
	June, 1898	85	....	....	....	......	....	8	....	......	4	50	....	6.50	153.50
	Total	4,139.25	25	22	9.5	5,210	15	14	113	5,728	16	514.5	148	305.50	16,876.75
No. 3	July, 1897	195.50	....	....	....	......	....	....	....	258	....	4.5	....	16.25	474.25
	August, 1897	154	....	....	....	350	....	....	....	284	....	.....	....	100.25	888.25
	September, 1897	516.25	....	....	....	1,100	....	....	....	622	....	.....	....	32.25	2,270.50
	October, 1897	241.50	....	....	....	2,010	....	....	....	1,665	....	.....	....	2	3,918.50
	November, 1897	621	....	....	....	1,490	....	....	....	1,930	....	324	....	9.50	4,374.50
	December, 1897	168	....	....	....	195	....	....	113	499	....	24	....	39	1,038
	January, 1898	522	....	....	....	145	....	....	....	200	6	.....	60	11	944
	February, 1898	562	25	15	9.5	......	....	6	....	......	....	.....	88	2	707.50
	March, 1898	1,395	....	7	....	......	15	....	....	......	....	36	....	30	1,483
	April, 1898	55	....	....	....	......	....	....	....	270	16	76	....	50	467
	May, 1898	103	....	....	....	......	....	....	....	......	48	.....	....	6.75	157.75
	June, 1898	85	....	....	....	......	....	8	....	......	4	50	....	6.50	153.50
	Total	4,618.25	25	22	9.5	5,290	15	14	113	5,728	74	514.5	148	305.50	16,876.75

S 4.

IMPROVEMENT OF WARRIOR AND TOMBIGBEE RIVERS, ALABAMA AND MISSISSIPPI.

This system of rivers forms the highway for the coal, etc., coming down the Black Warrior River, as well as the natural communication for western Alabama and eastern Mississippi that lies contiguous to the upper Tombigbee.

The work done on this system is divided into sections, as follows:

(*a*) Warrior River, from the mouth to Tuscaloosa, a distance of 130 miles.

(*b*) Tombigbee River, from mouth to Demopolis, a distance of 191 miles.

(*c*) Tombigbee River, from Demopolis, Ala., to Columbus, Miss., a distance of 156 miles.

(*d*) Tombigbee River, from Columbus to Fulton, a distance of 144 miles.

(*e*) Tombigbee River, from Fulton to Walkers Bridge, a distance of 24¾ miles.

The approved project on sections *a*, *b*, and *c* propose the use of locks and dams; on *d* and *e* only snagging and temporary work in the way of dikes, etc.

To keep up navigation on these rivers it will be necessary to keep up the removal of snags, drift, etc., which accumulate annually; also to do some dredging and removal of sand, gravel, etc.

As the estimates for these improvements are only for building locks and dams, it follows that the yearly expenditures for snagging, etc., reduce the amount necessary to complete the improvements as shown on paper, but really this amount is not reduced. I respectfully recommend that the appropriations hereafter be asked for separately for the operation of snag boats and parties engaged in bank work, dike work, and removing accumulations of sand, gravel, etc.

On sections *a*, *b*, and *c* there will be necessary, annually, $45,000.

(*a*) WARRIOR RIVER, ALABAMA.

For original condition of this section and for work done prior to June 30, 1897, see pages 1679 and 1680, Annual Report of 1897.

WORK OF THE PAST YEAR.

During the past year the snag boats *Vienna* and *Demopolis* have worked over the river from Robertson's Upper Landing to the mouth, a distance of 116 miles. During October the river became so low that it was necessary to tie up the boats, but the crews continued work on the channel, using a barge and yawls. In this manner they removed snags and shattered obstructions with dynamite. This work ceased on December 4.

Extensive improvements were made at Tressells Bar, Izzard Shoal, Drop-Out Bar, Morrows Rock, Jennings Ferry Bar, McAlpins Bar, and Hatchs Bar. In each location the channel was opened and cleared by scrapers, after which dams and training walls were built of piles interwoven with brush—fascines held by galvanized wire.

Sketches showing these locations before and after improvement accompany this report.

On July 1, 1897, a survey party was organized and was in the field until December 23, 1897, when it was disbanded on account of high water. On May 23, 1898, the party was reorganized and it is now at work. Since July 1, 1897, it has carefully surveyed 71 miles of river, thus completing the survey to within 58½ miles of the mouth. Borings are now being made and test-pits sunk at proposed lock sites.

Work on this section of the river has for the past year consisted of felling overhanging trees, removing snags, excavating rock, sand, and clay; building training walls and dams, sinking test-pits, boring, and completing 71 miles of a new survey.

The total amount expended on this improvement up to June 30, 1898, is $222,278.26.

Money statement.

July 1, 1897, balance unexpended	$48, 483. 20
June 30, 1898, amount expended during fiscal year	40, 761. 46
July 1, 1898, balance unexpended	7, 721. 74
July 1, 1898, outstanding liabilities	389. 52
July 1, 1898, balance available	7, 332. 22
Amount (estimated) required for completion of existing project	1, 320, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	500, 000. 00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Appropriations were made as follows:

Warrior and Tombigbee rivers:		
March 3, 1875	$25, 000	
August 14, 1876	15, 000	
June 18, 1878	28, 000	
March 3, 1879	20, 000	
Warrior River:		
June 14, 1880	20, 000	
March 3, 1881	10, 622	
August 2, 1882	10, 000	
July 5, 1884	12, 000	
August 5, 1886	18, 750	
August 11, 1888	18, 000	
		$177, 372

The following appropriations have been made by Congress:

September 19, 1890	$45, 000	
July 13, 1892	75, 000	
August 18, 1894	40, 000	
June 3, 1896	70, 000	
		230, 000
		407, 372

COMMERCIAL STATISTICS.

Articles.	1898.	1897.	1896.
	Tons.	*Tons.*	*Tons.*
Cotton	1, 500	2, 080	1, 250
Grain	2, 500	2, 100	1, 300
Iron	20	20	20
Lumber	60	50	50
General merchandise	2, 000	1, 300	1, 200
Coal	4, 616	2, 000	500
Total	10, 696	7, 550	4, 320

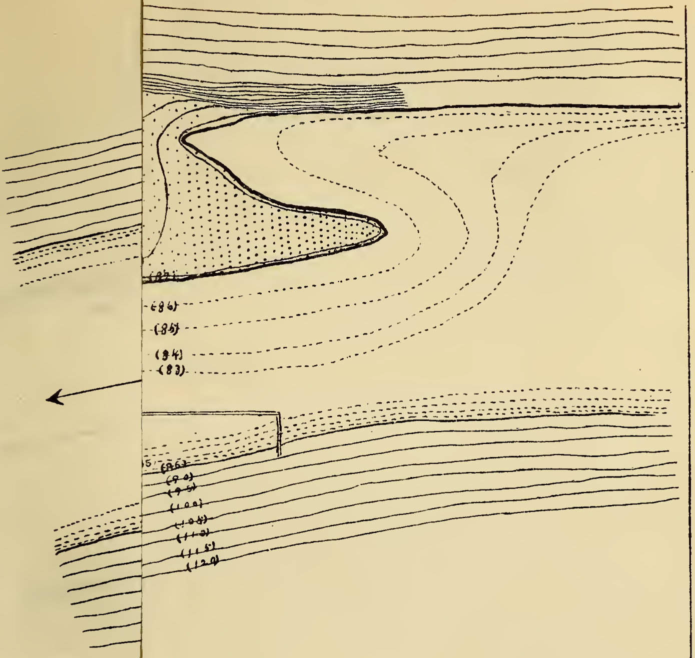
(*b*) TOMBIGBEE RIVER FROM ITS MOUTH TO DEMOPOLIS.

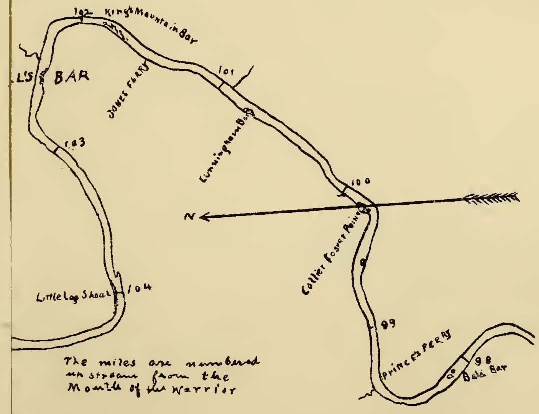
ORIGINAL CONDITION OF WORK.

For original condition of work and for work done prior to June 30, 1897, see pages 1685 and 1686, Annual Report for 1897.

PLAN OF IMPROVEMENT.

The present plan of improvement is to secure a channel 6 feet deep at low water by removal of obstructions, bank revetment, and the construction of locks and dams.





The miles are numbered up stream from the Mouth of the Warrior

Money statement.

July 1, 1897, balance unexpended	$48,483.20
June 30, 1898, amount expended during fiscal year	40,761.46
July 1, 1898, balance unexpended	7,721.74
July 1, 1898, outstanding liabilities	389.52
July 1, 1898, balance available	7,332.22
Amount (estimated) required for completion of existing project	1,320,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations were made as follows:

Warrior and Tombigbee rivers:		
March 3, 1875	$25,000	
August 14, 1876	15,000	
June 18, 1878	28,000	
March 3, 1879	20,000	
Warrior River:		
June 14, 1880	20,000	
March 3, 1881	10,622	
August 2, 1882	10,000	
July 5, 1884	12,000	
August 5, 1886	18,750	
August 11, 1888	18,000	
		$177,372

The following appropriations have been made by Congress:

September 19, 1890	$45,000	
July 13, 1892	75,000	
August 18, 1894	40,000	
June 3, 1896	70,000	
		230,000
		407,372

COMMERCIAL STATISTICS.

Articles.	1898.	1897.	1896.
	Tons.	*Tons.*	*Tons.*
Cotton	1,500	2,080	1,250
Grain	2,500	2,100	1,300
Iron	20	20	20
Lumber	60	50	50
General merchandise	2,000	1,300	1,200
Coal	4,616	2,000	500
Total	10,696	7,550	4,320

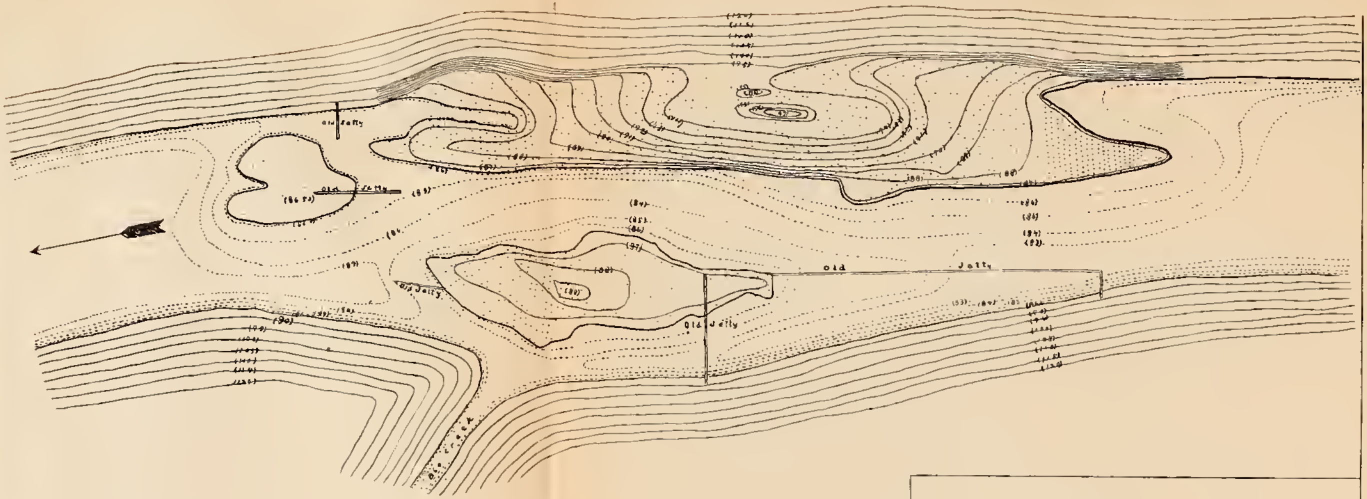
(*b*) TOMBIGBEE RIVER FROM ITS MOUTH TO DEMOPOLIS.

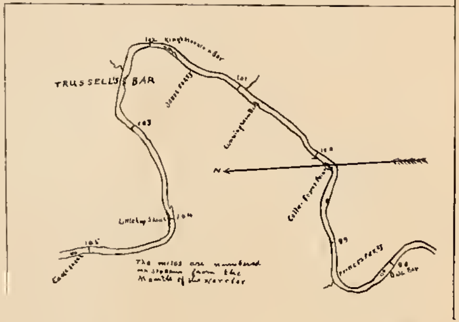
ORIGINAL CONDITION OF WORK.

For original condition of work and for work done prior to June 30, 1897, see pages 1685 and 1686, Annual Report for 1897.

PLAN OF IMPROVEMENT.

The present plan of improvement is to secure a channel 6 feet deep at low water by removal of obstructions, bank revetment, and the construction of locks and dams.

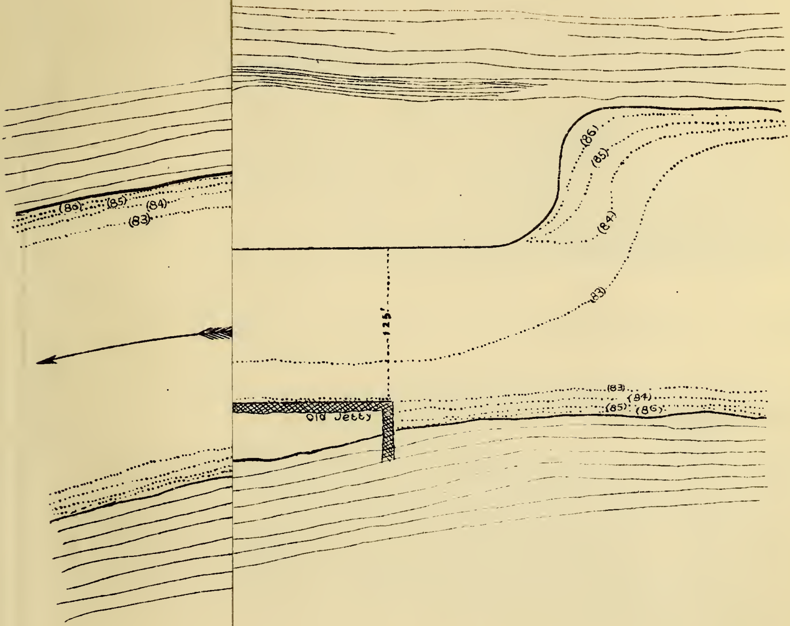


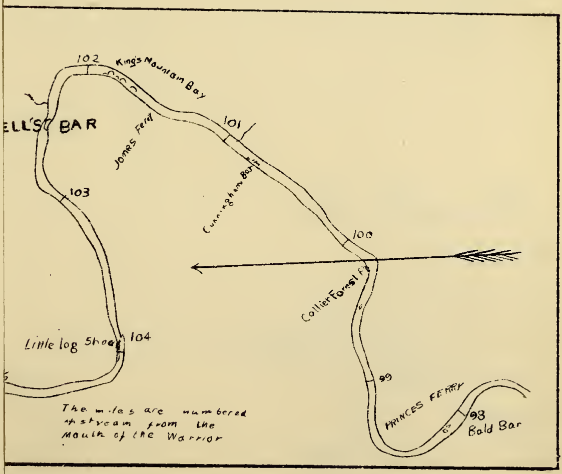

TRUSSELL'S BAR
102
101
103
100
104
Littleby Shoal
105
99
98
N
The miles are numbered up stream from the Mouth of the Warrior

Sketch of Trussell's Bar
Warrior River
Before Improvement,
Elevations Referred to Mobile Datum,
Scale 150' per inch,
Aug. 19, 1896.

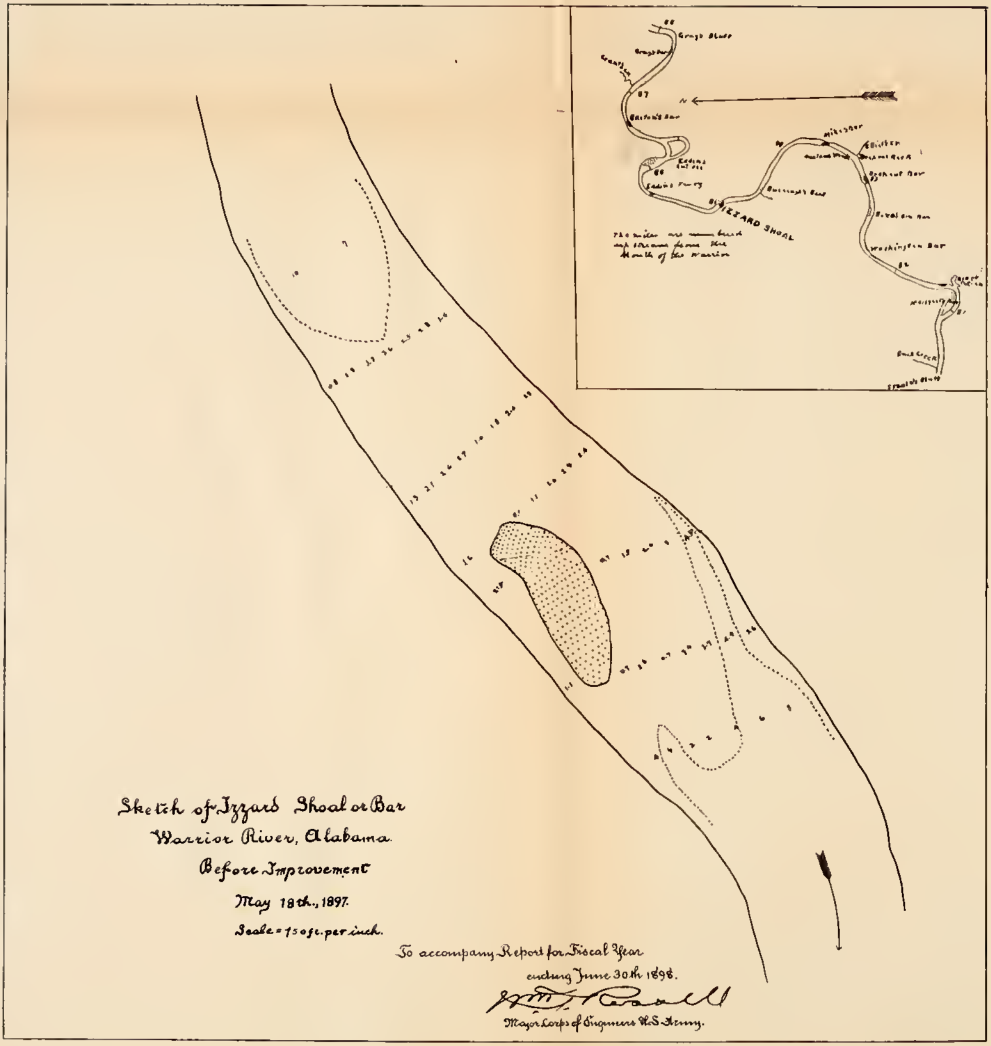
To accompany Report for Fiscal Year
ending June 30th 1898.

Wm. T. Rossell
Major Corps of Engineers U.S. Army.





The miles are numbered upstream from the Mouth of the Warrior

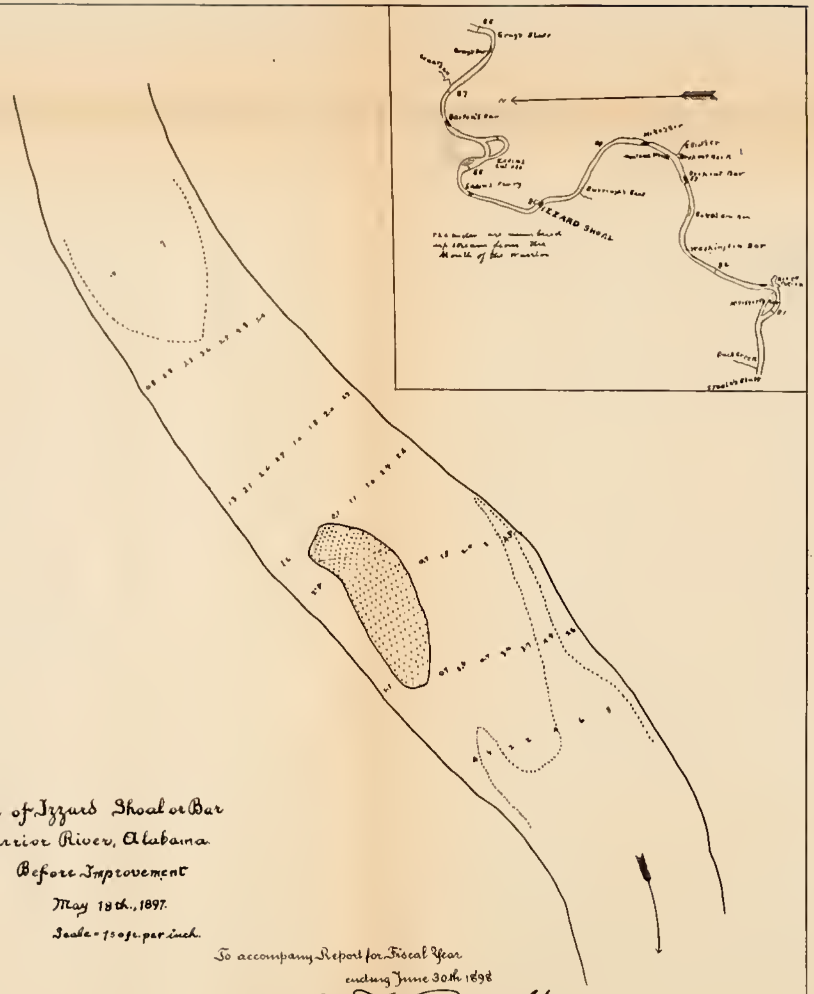

Grays Bluff
N
IZZARD SHOAL
Washington Bar
Spanish Bluff
The miles are numbered up stream from the Mouth of the Warrior

Sketch of Izzard Shoal or Bar
Warrior River, Alabama.
Before Improvement
May 18th., 1897.
Scale = 150 ft. per inch.

To accompany Report for Fiscal Year
ending June 30th 1898.

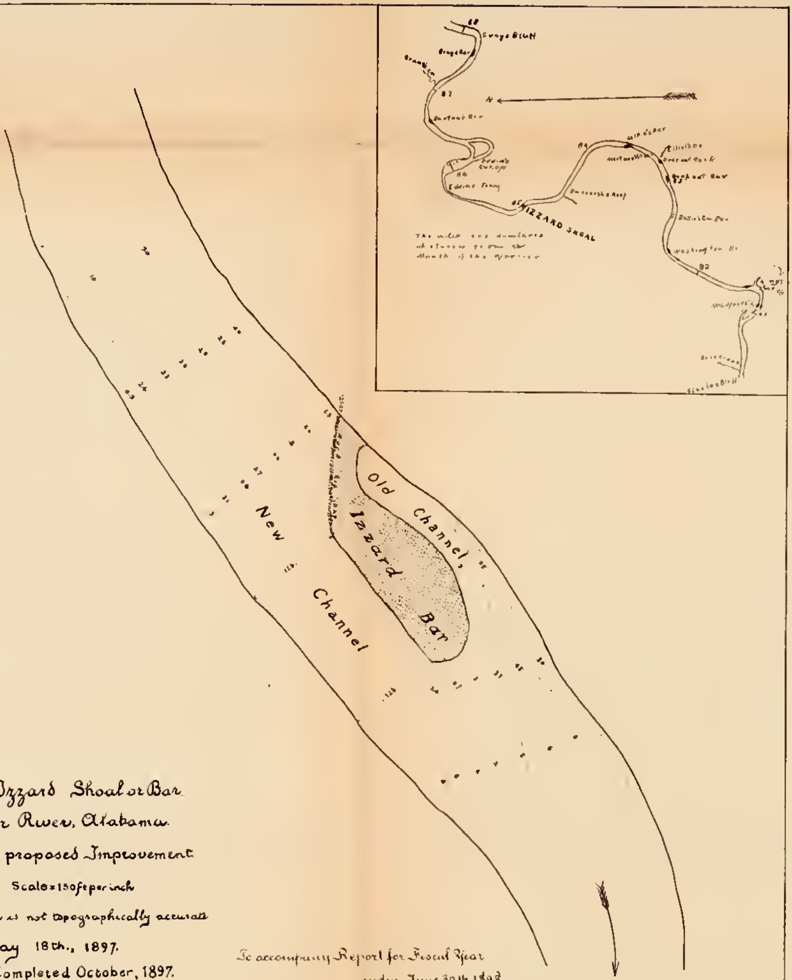
Wm. T. Rossell
Major Corps of Engineers U.S. Army.

3


N
IZZARD SHOAL
Washington Bar
87
88
The miles are numbered up stream from the Mouth of the Warrior

Sketch of Izzard Shoal or Bar
Warrior River, Alabama
Before Improvement
May 18th., 1897.
Scale = 150 ft. per inch.

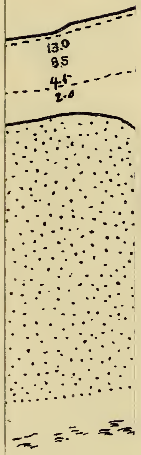
To accompany Report for Fiscal Year
ending June 30th 1898
Wm. T. Rossell
Major, Corps of Engineers U.S. Army



Sketch of Izzard Shoal or Bar
Warrior River, Alabama.
Showing proposed Improvement
Scale = 150 ft per inch
Remark. This sketch is not topographically accurate
May 18th., 1897.
Improvement Completed October, 1897.

To accompany Report for Fiscal Year
ending June 30th 1898.

Major Corps of Engineers U.S. Army


13.0
8.5
4.5
2.0

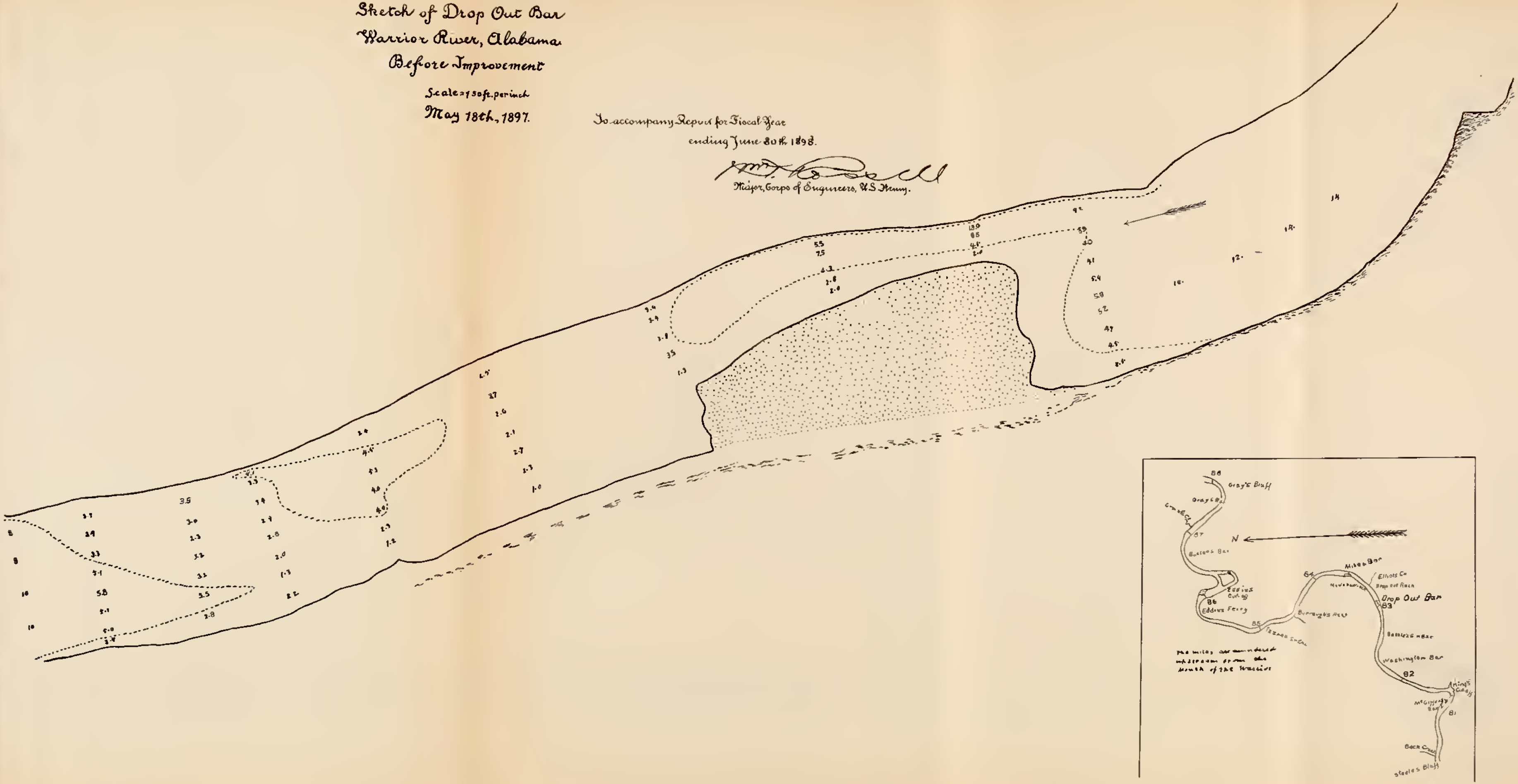
Sketch of Drop Out Bar
Warrior River, Alabama
Before Improvement

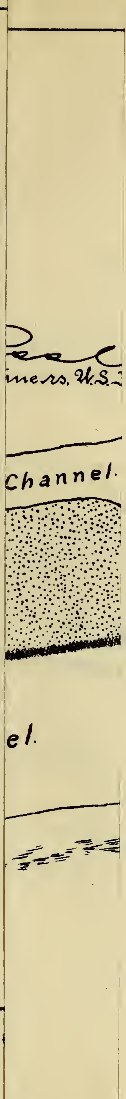
Scale=150ft. per inch

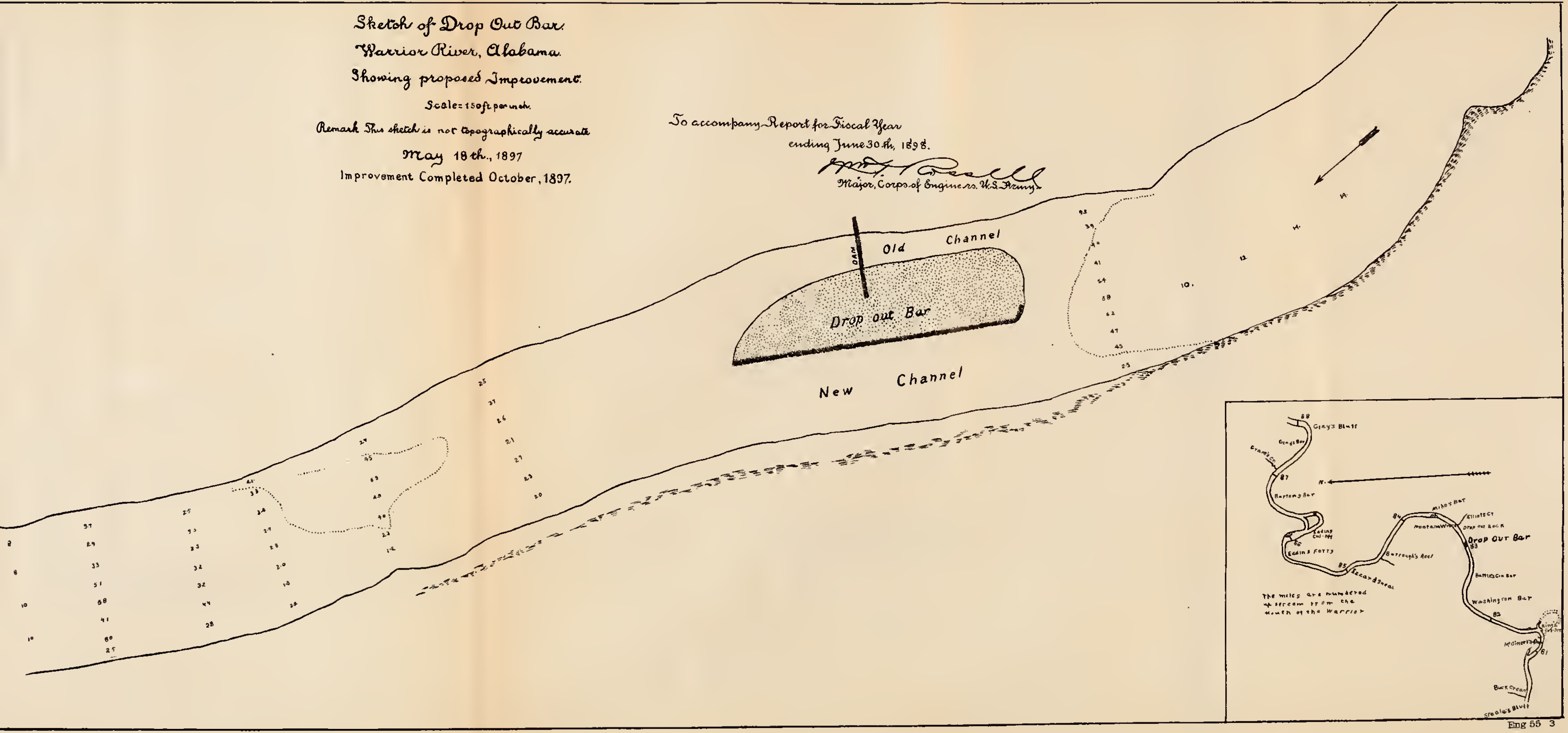
May 18th, 1897.

To accompany Report for Fiscal Year
ending June 30th 1898.

Wm. T. Rossell
Major, Corps of Engineers, U.S. Army.



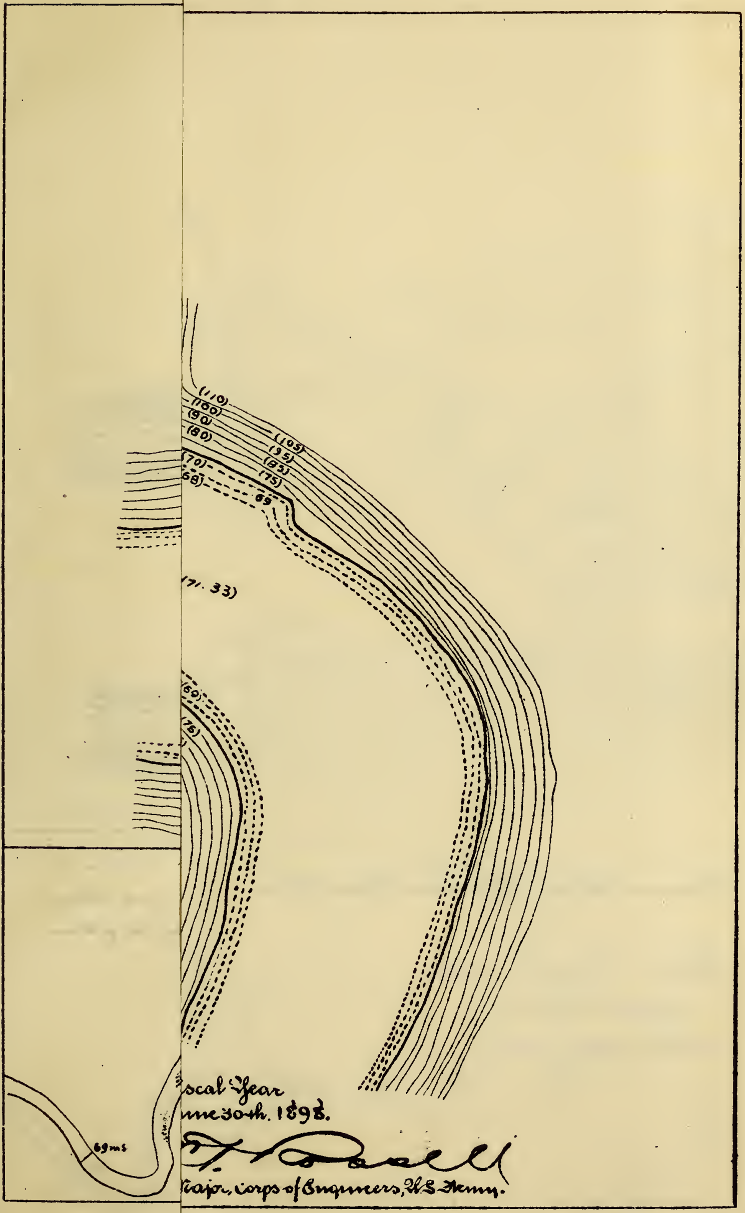

ineers, U.S.
Channel.
el.



Sketch of Drop Out Bar, Warrior River, Alabama.
Showing proposed Improvement.
Scale: 150 ft. per inch.
Remark This sketch is not topographically accurate
May 18th., 1897
Improvement Completed October, 1897.

To accompany Report for Fiscal Year
ending June 30th, 1898.
Wm T. Rossell
Major, Corps of Engineers, U.S. Army.

The miles are numbered up stream from the mouth of the Warrior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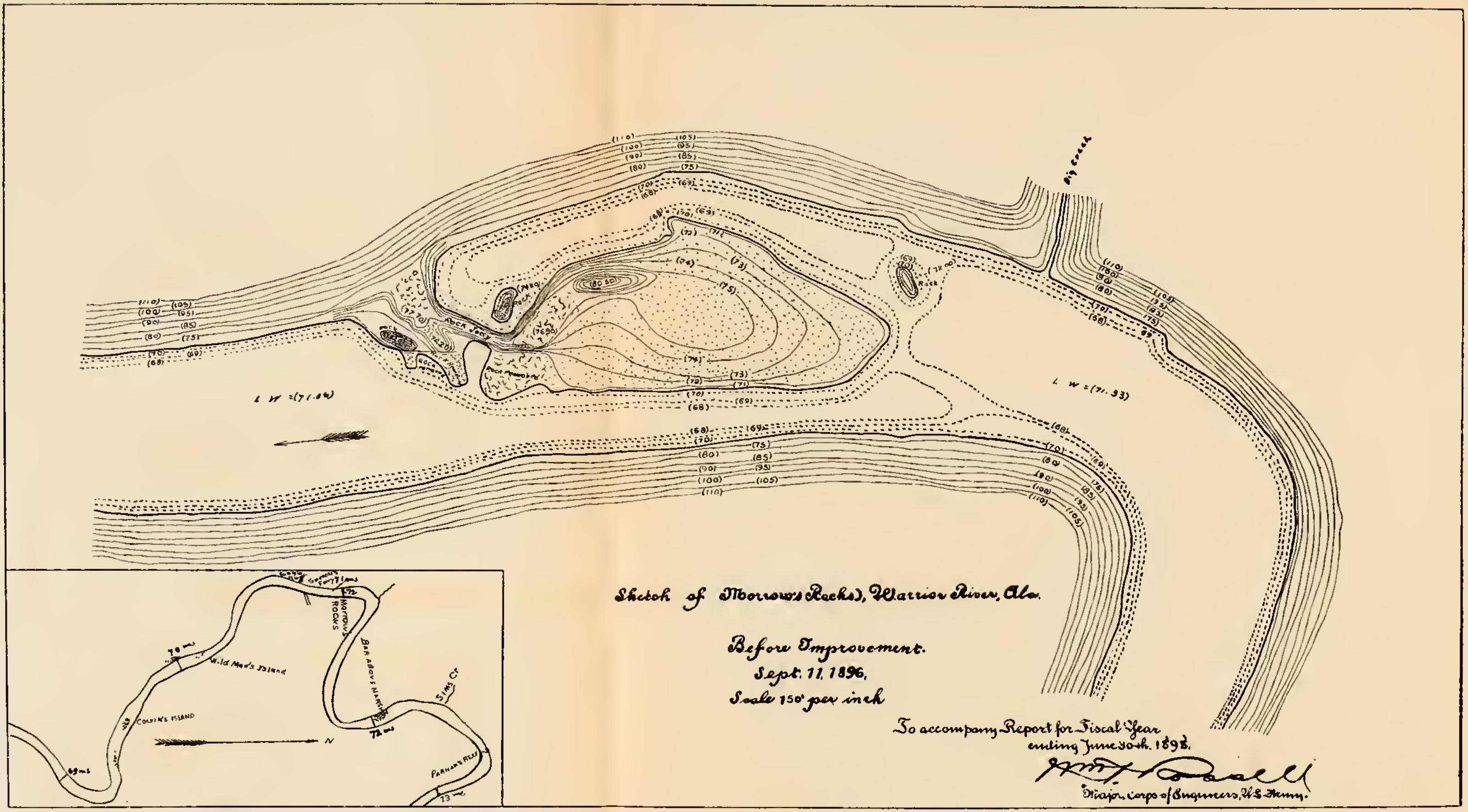
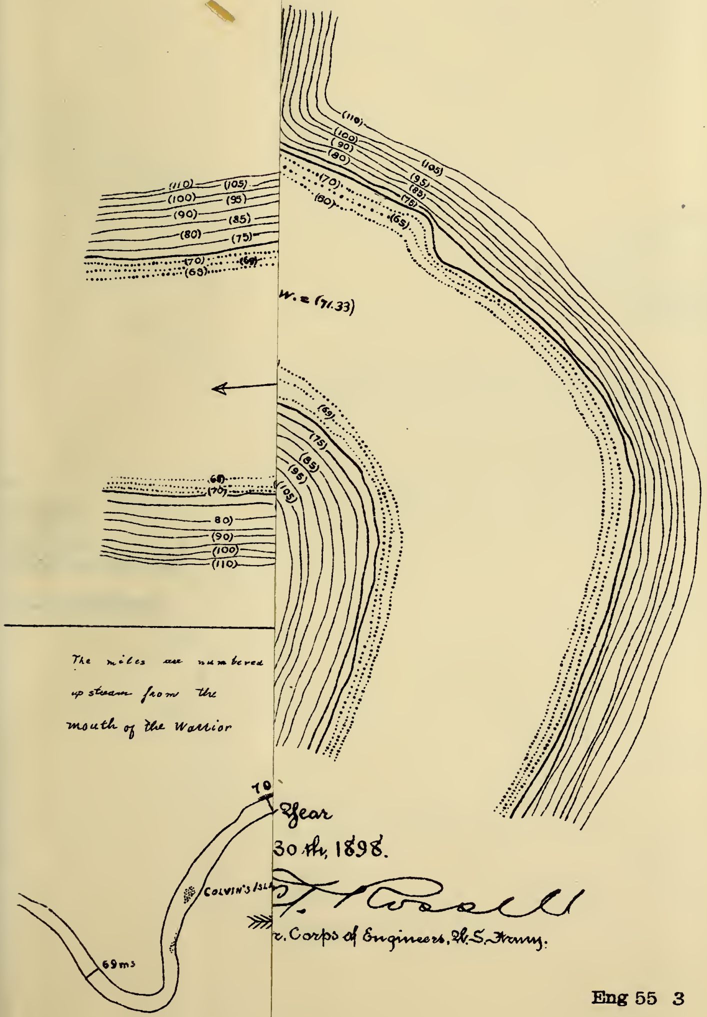


Sketch of Morrow's Rocks, Warrior River, Ala.

Before Improvement.
Sept. 11. 1896.
Scale 150' per inch

To accompany Report for Fiscal Year
ending June 30th. 1898.

Wm T Rossell
Major, Corps of Engineers, U.S. Army.



The miles are numbered up stream from the mouth of the Warrior

Year

30th, 1898.

T. Powell

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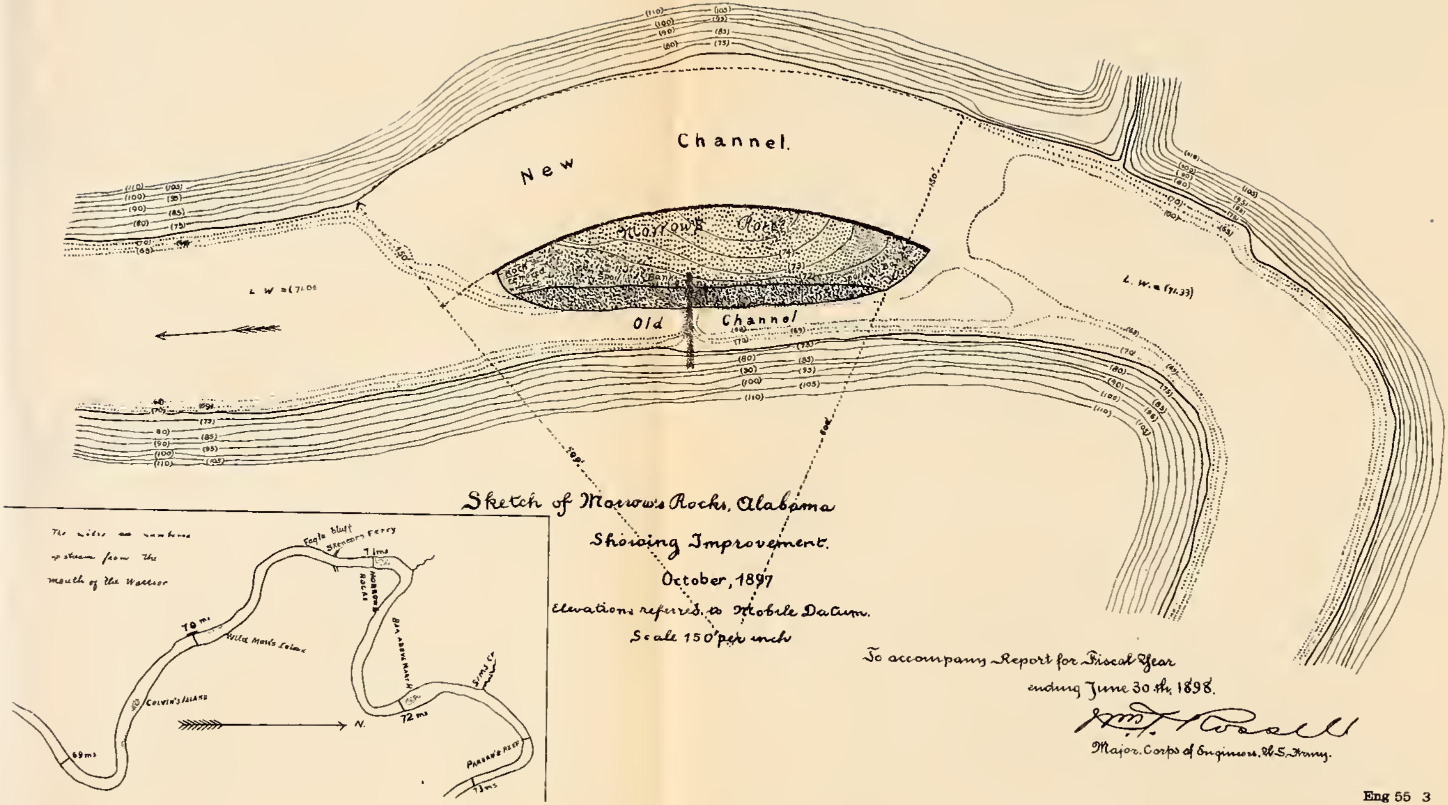

Sketch of Morrow's Rocks, Alabama

Showing Improvement.

October, 1897

Elevations referred to Mobile Datum.

Scale 150' per inch

To accompany Report for Fiscal Year
ending June 30th, 1898.

Wm. T. Rossell
Major. Corps of Engineers. U.S. Army.

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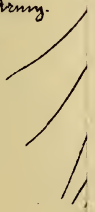
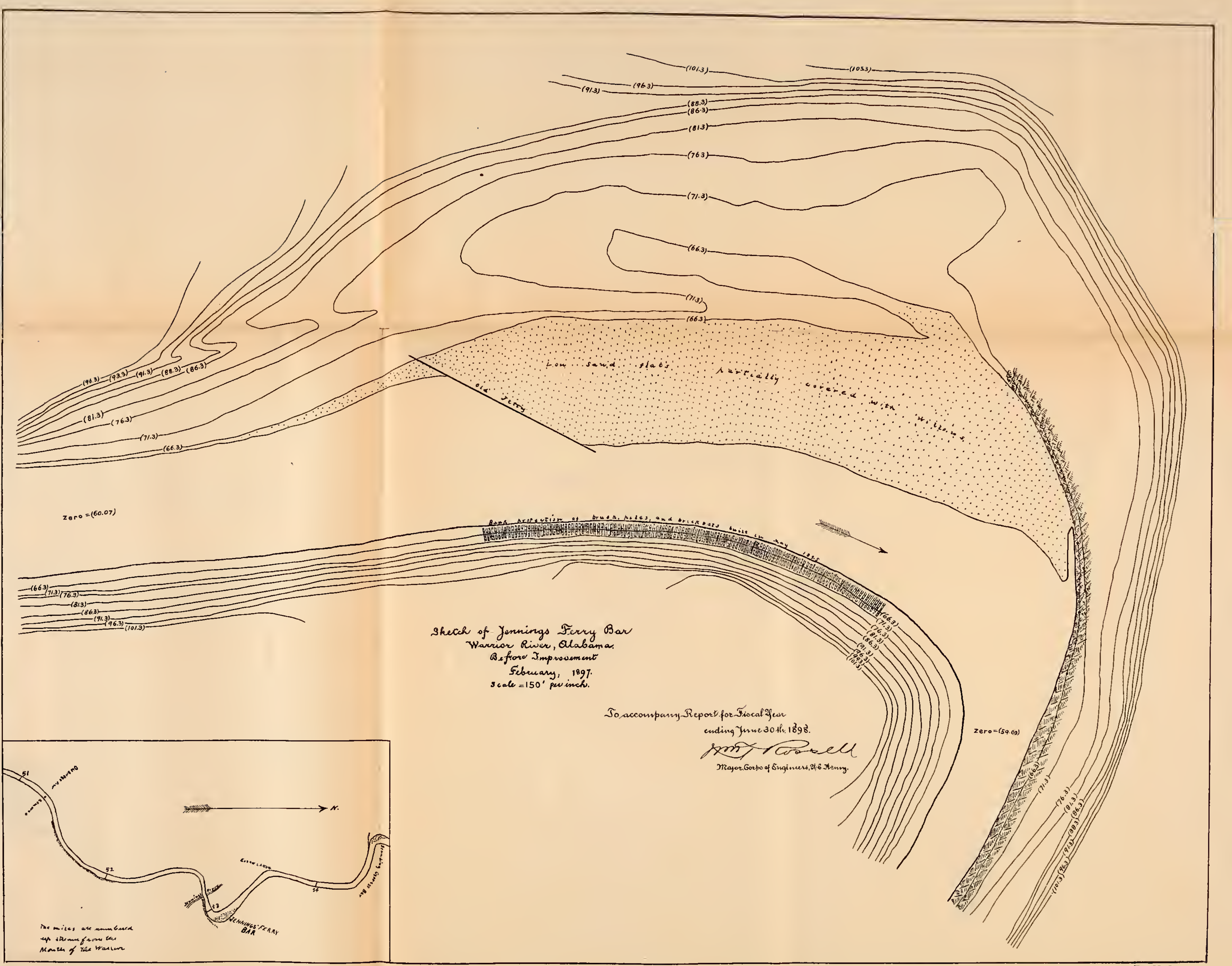
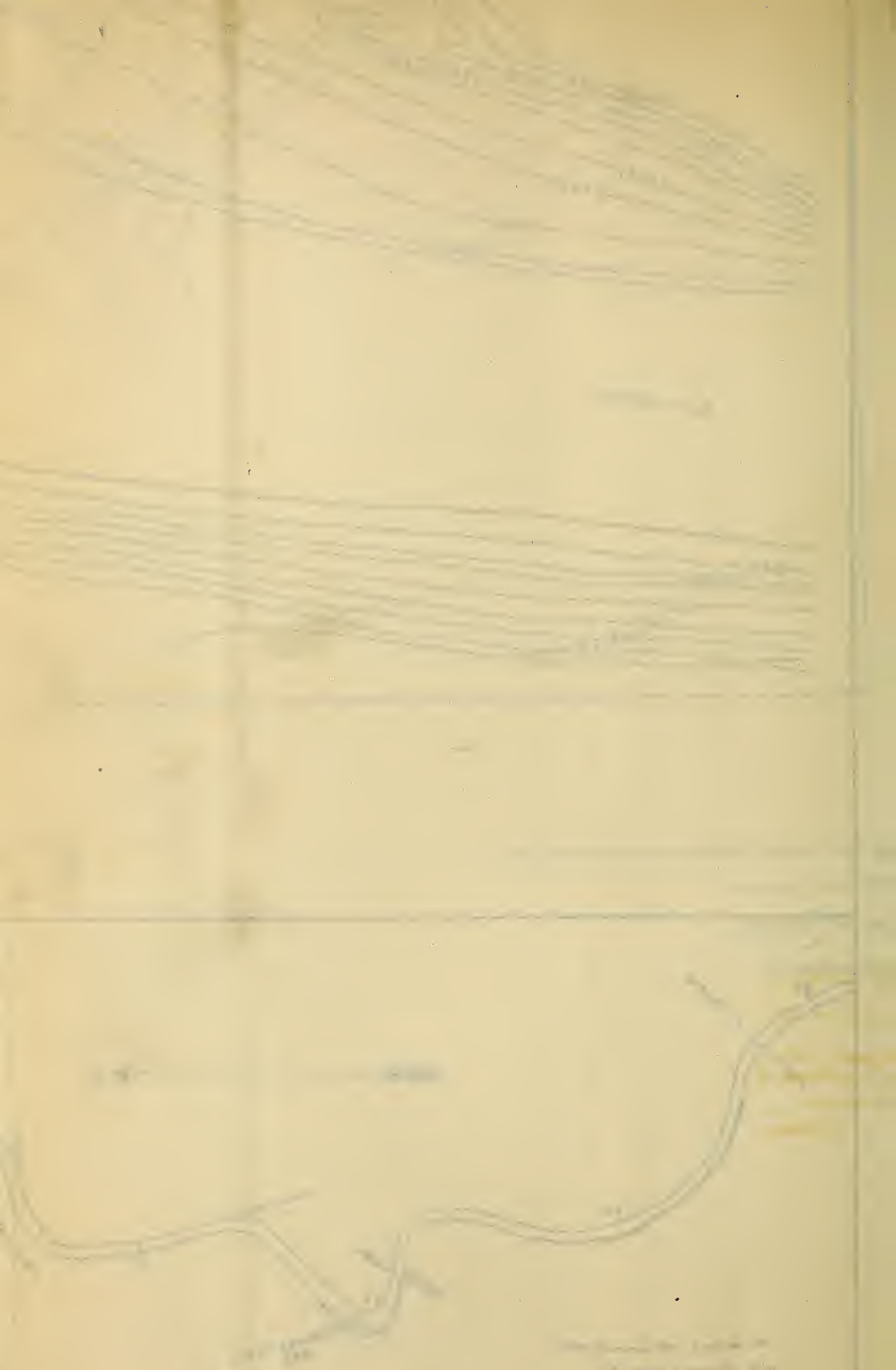




Sketch of Jennings Ferry Bar
Warrior River, Alabama.
Before Improvement
February, 1897.
Scale = 150' per inch.

To accompany Report for Fiscal Year
ending June 30th. 1898.

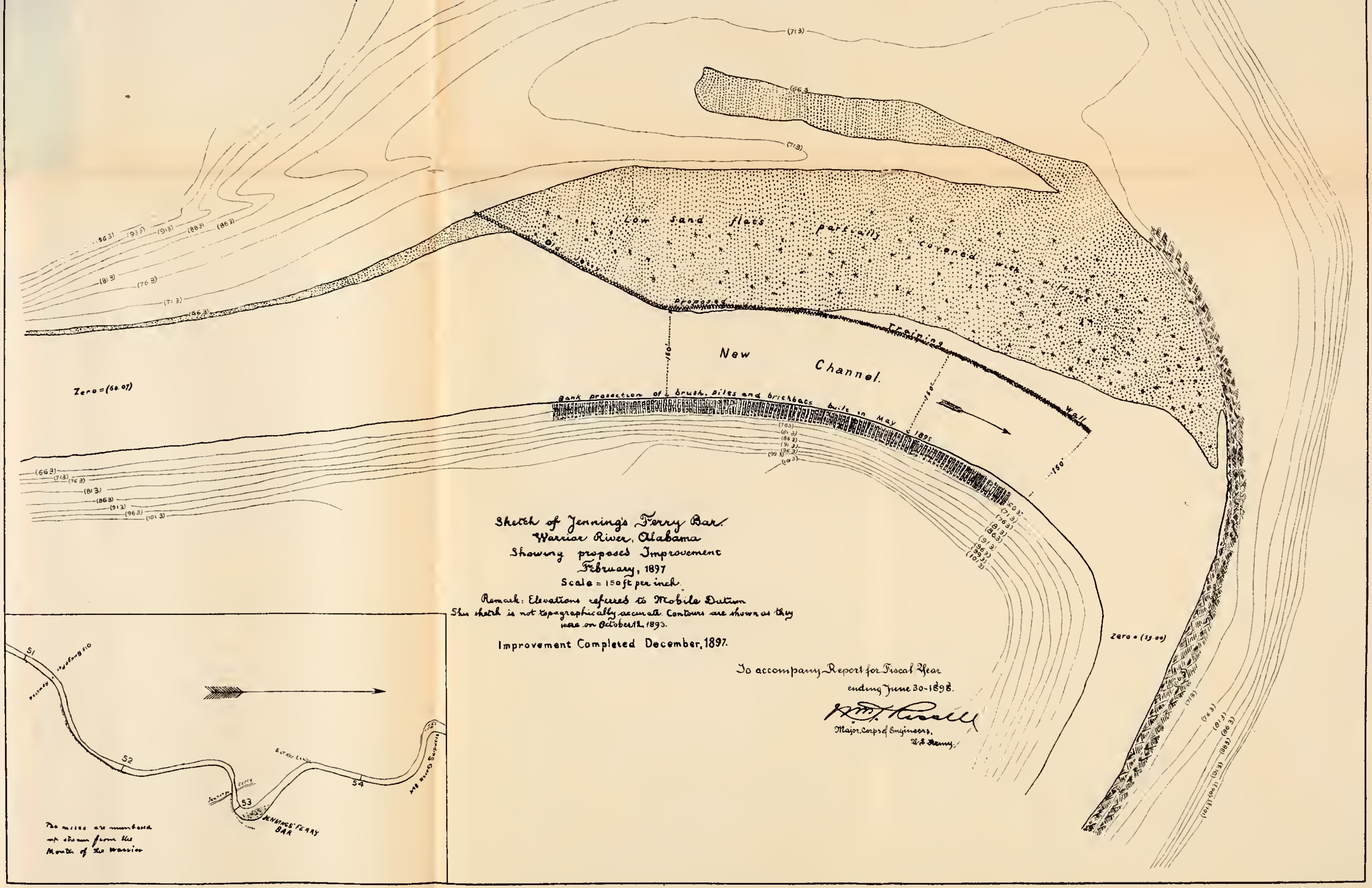
Wm. T. Rossell
Major, Corps of Engineers, U.S. Army.



10

Fiscal Year
June 30-1898.

of Engineers.
W. L. Henry



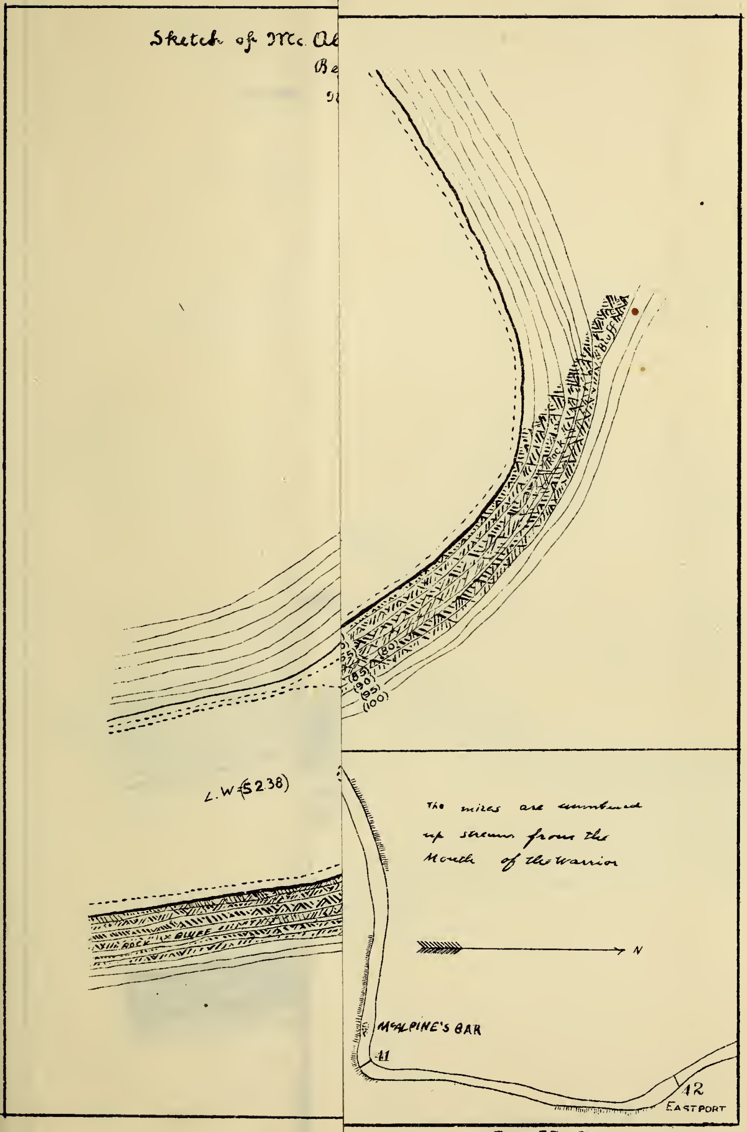
Sketch of Jenning's Ferry Bar.
Warrior River, Alabama
Showing proposed Improvement
February, 1897
Scale = 150 ft per inch.

Remark: Elevations referred to Mobile Datum
This sketch is not topographically accurate. Contours are shown as they were on October 12, 1893.

Improvement Completed December, 1897.

To accompany Report for Fiscal Year
ending June 30-1898.

W. T. Russell
Major, Corps of Engineers,
U.S. Army.


Sketch of Mc Al
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The miles are numbered up stream from the Mouth of the Warrior

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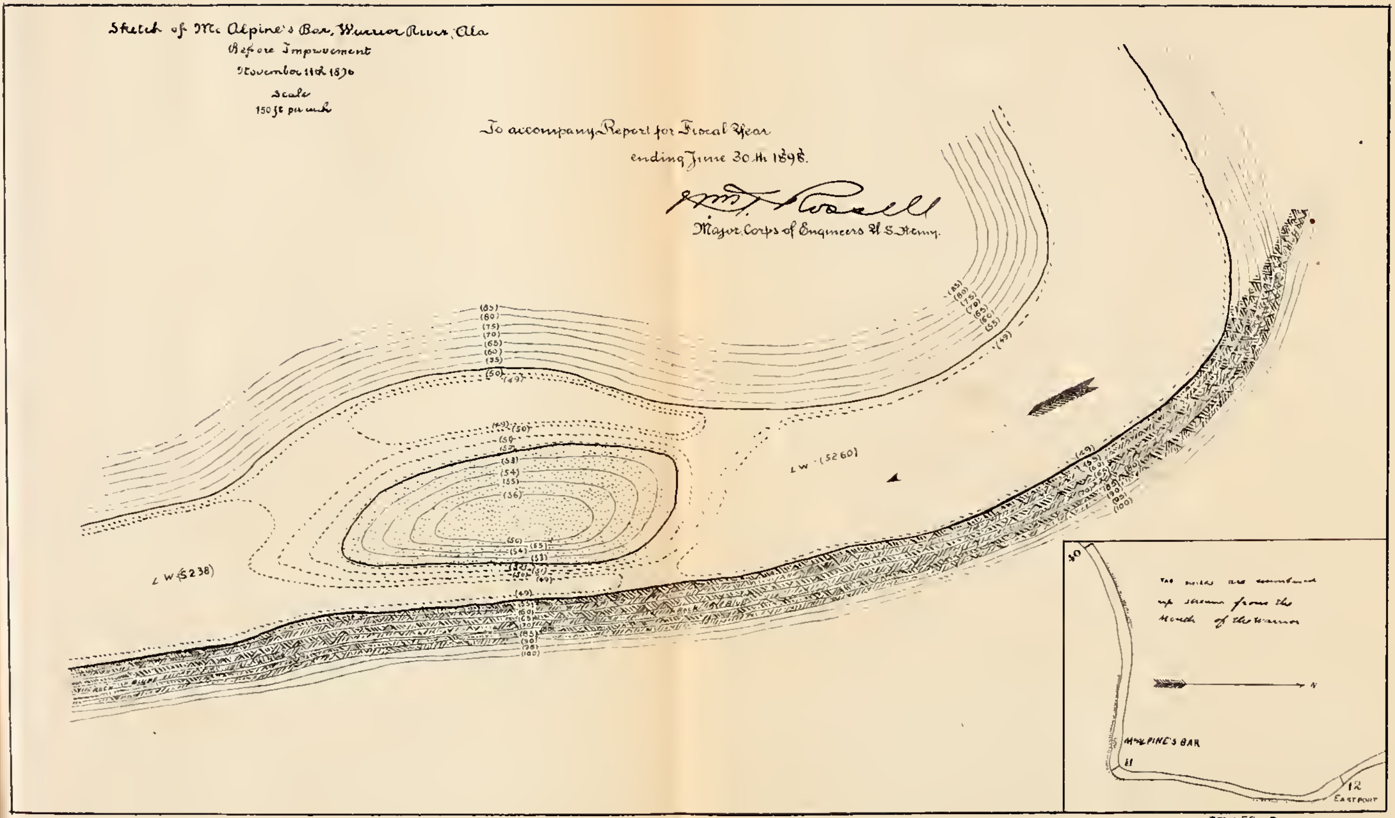


Sketch of Mc Alpine's Bar, Warrior River, Ala

Before Improvement

November 11th 1896

Scale

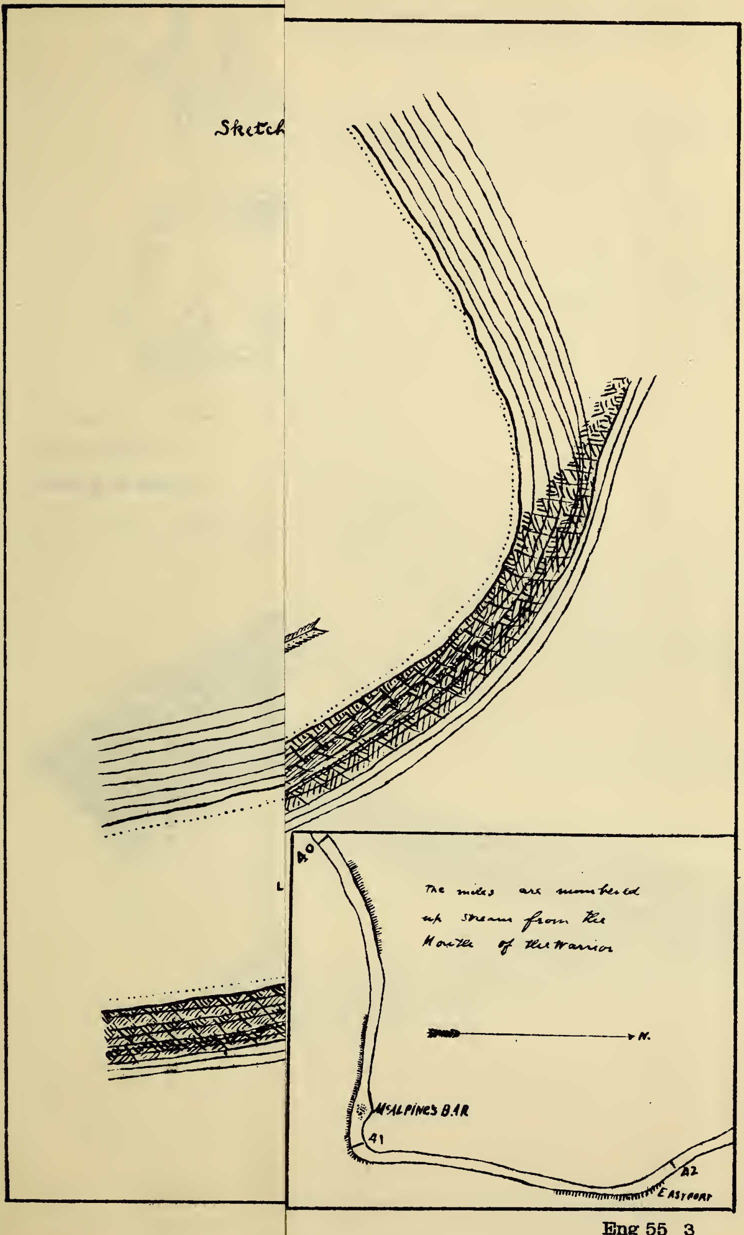
150 ft per inch

To accompany Report for Fiscal Year

ending June 30th 1898.

Wm T Rossell

Major, Corps of Engineers U S Army.



The miles are numbered up stream from the Mouth of the Warrior

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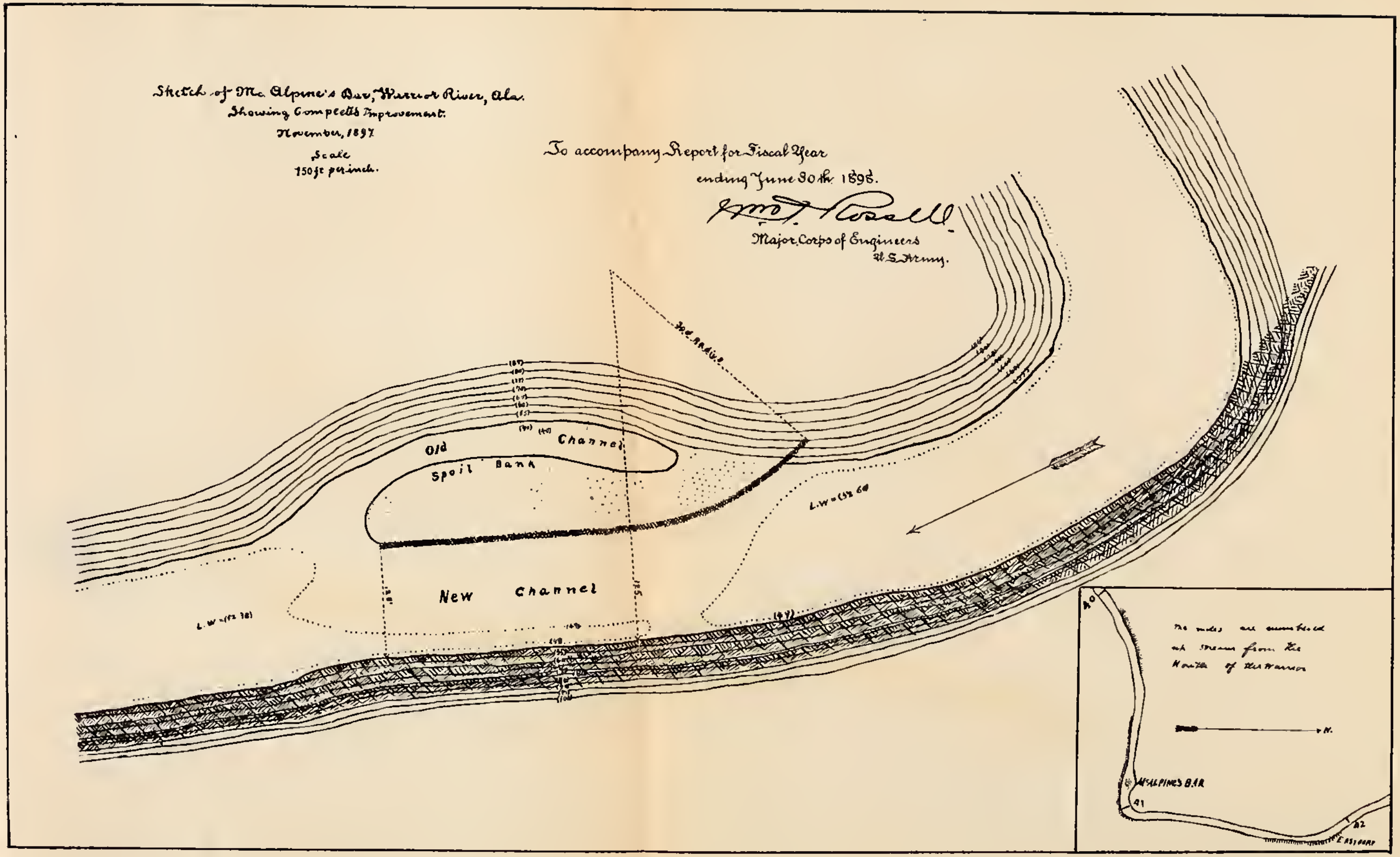
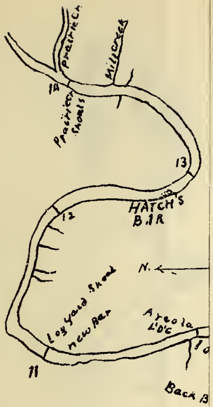
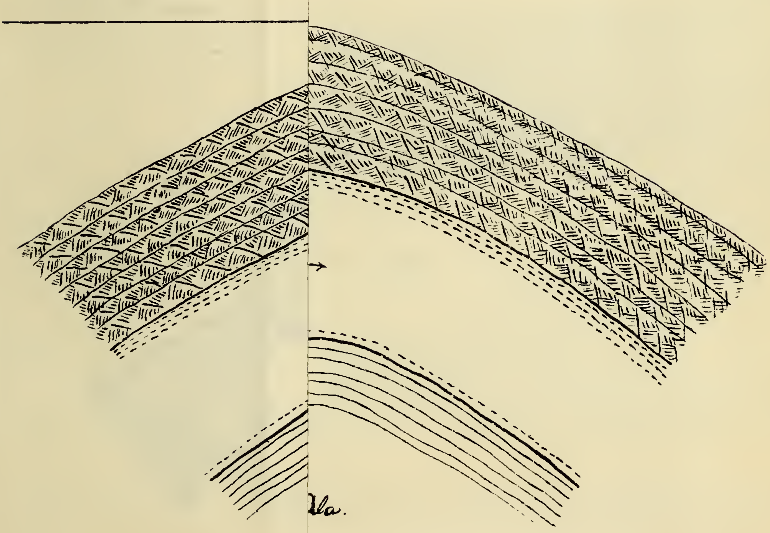

Sketch of Mc Alpine's Bar, Warrior River, Ala.
Showing Completed Improvement.
November, 1897.
Scale
150 ft per inch.

To accompany Report for Fiscal Year
ending June 30th 1898.
Wm. T. Rossell
Major, Corps of Engineers
U. S. Army.

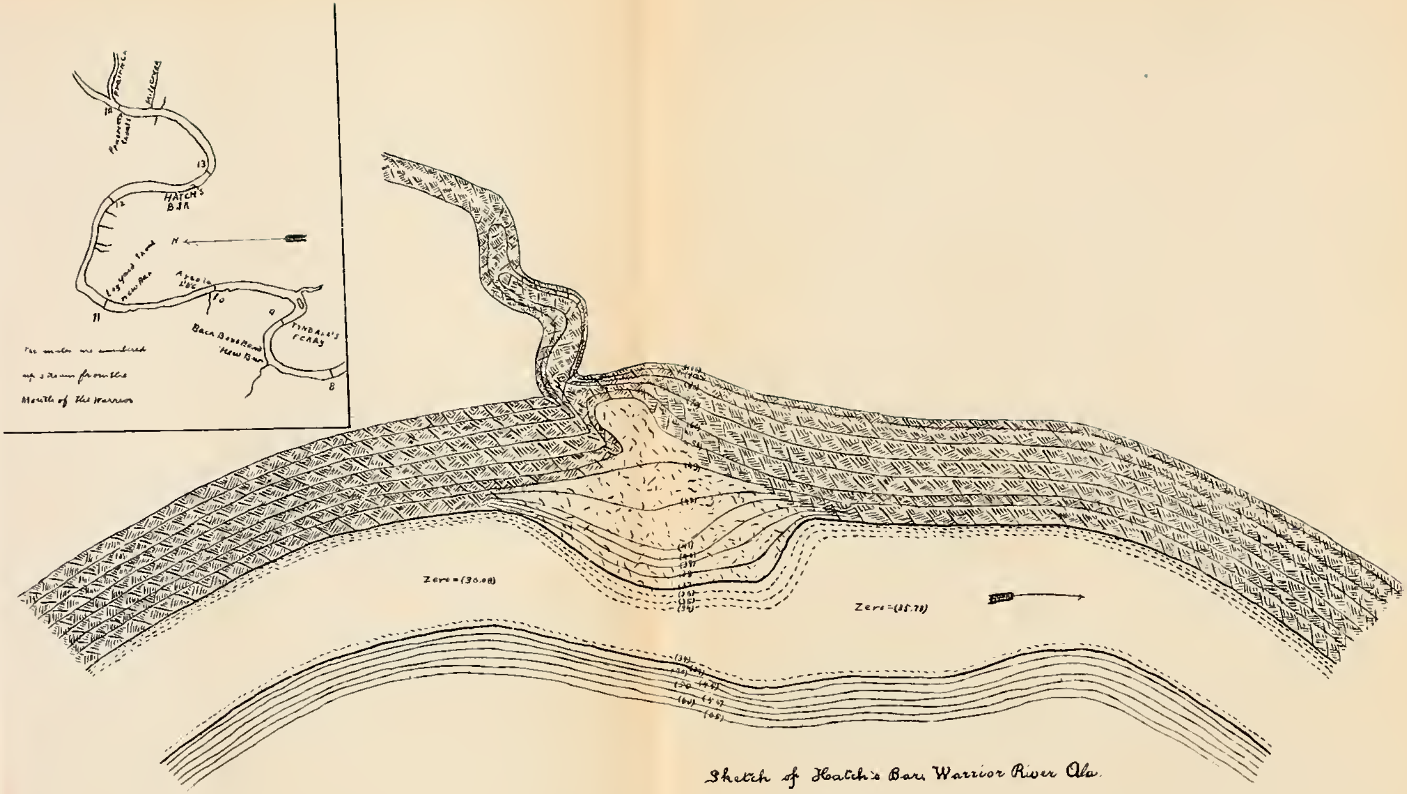
The miles are numbered up stream from the Mouth of the Warrior



The miles are numbered
up stream from the
Mouth of the Warrior



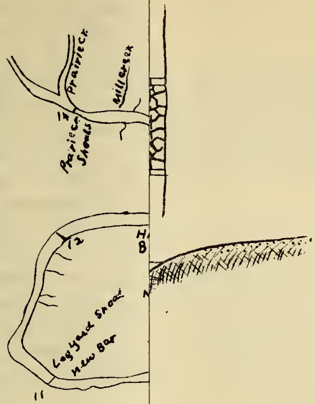
Ala.



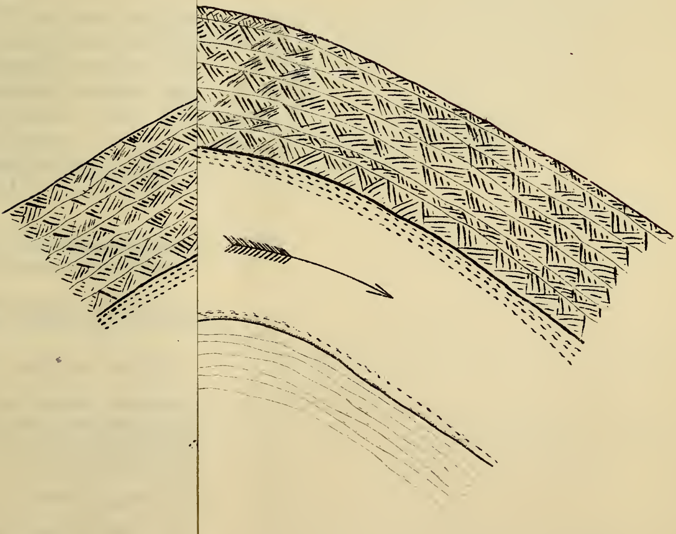
Sketch of Hatch's Bar. Warrior River Ala.
Before Improvement.
December 10, 1896.
Scale = 150' per inch.

To accompany Report for Fiscal Year
ending June 30th, 1898.

Wm. T. Rossell
Major Corps of Engineers U. S. Army.



The miles are numbered
up stream from the
Mouth of the Warrior



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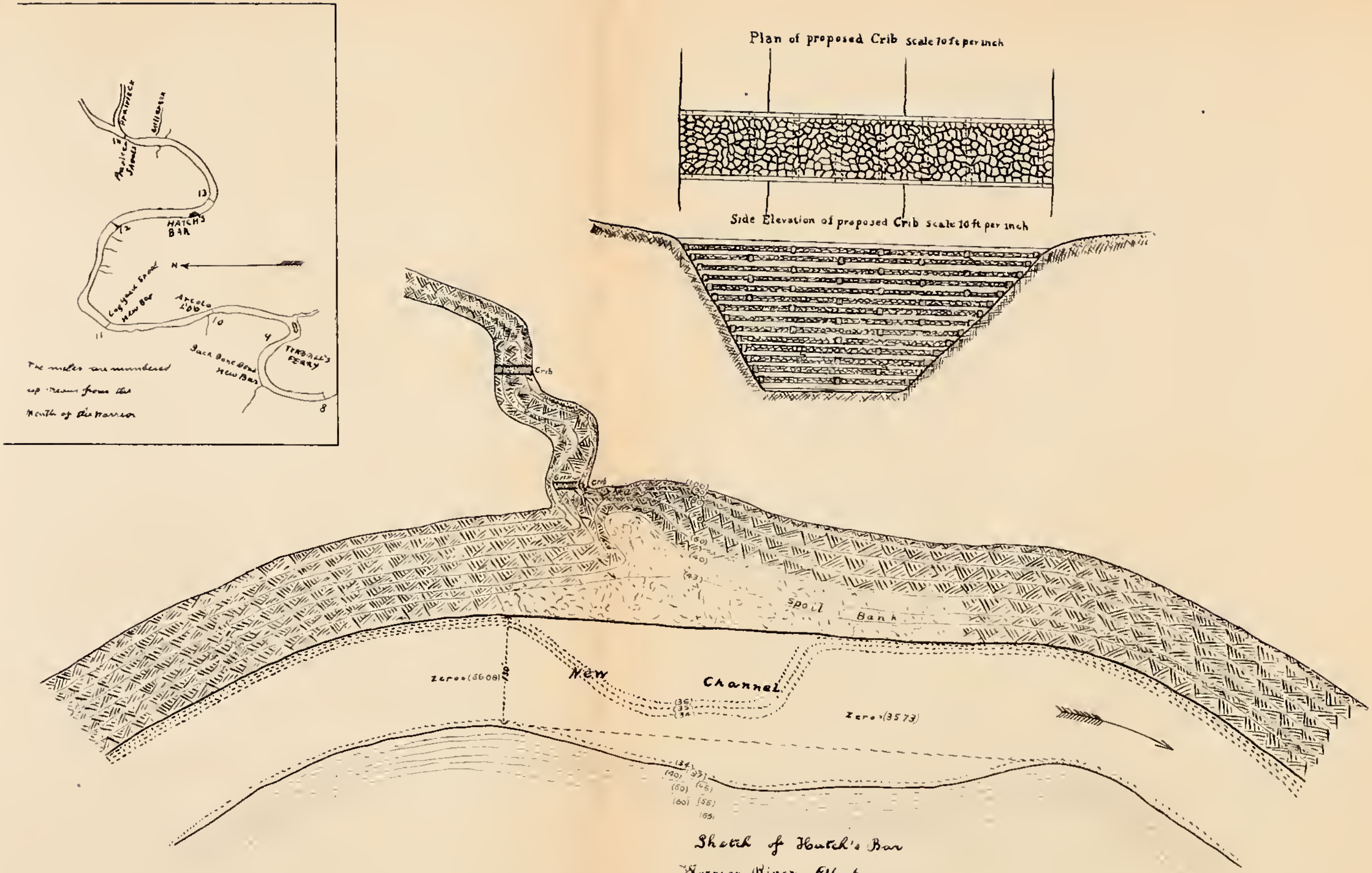

Plan of proposed Crib Scale 10 ft per inch

Side Elevation of proposed Crib Scale 10 ft per inch

The miles are numbered up stream from the Mouth of the Warrior

Sketch of Hatch's Bar
Warrior River, Alabama.
Showing Completed Improvement
November, 1897
Scale
750 ft. per inch

To accompany Report for Fiscal Year
ending June 30th 1898.
Wm. T. Rossell
Major, Corps of Engineers, U.S. Army.

WORK OF THE PAST YEAR.

Snagging and dredging was carried on by snag boat *Tombigbee* and steam dredge *Black Warrior*.

On the 28th of August the boom of the *Black Warrior* broke, seriously wrecking the dredging apparatus, since which time the boat has been laid up at McGrews Shoal.

On July 1, 1897, the snag boat *Tombigbee* was removing snags between McDowells and Moscow. On July 19, 1897, she was sent to the mouth of the river and began working upstream, removing snags previously passed as not necessarily dangerous and such as had recently washed into the channel. While working upstream the boat was occasionally sent to locations in advance where navigation had become difficult, but after the obstructions had been removed she would return to the point she had left and resume systematic operations. At the end of the fiscal year the *Tombigbee* had progressed as far as Mungers, 41 miles.

On June 18, 1898, the *Tombigbee* was inspected by the United States local inspectors of hulls and boilers and found in good condition.

SUMMARY OF WORK.

The following is a table of work performed by the *Black Warrior* and the *Tombigbee* during the fiscal year ending June 30, 1898:

Overhanging trees cut		16
Logs on banks cut up		4
Snags removed from river		1,235
Stumps removed or leveled		113
Gravel excavated	cubic yards	595
Earth excavated	do	1,381
Rocks removed		242
Miles traveled		1,142

Work on the lock and dam at McGrews Shoal has progressed during the year, with three interruptions by high water. The two walls, as far as constructed, contain 4,228 cubic yards of concrete.

Two progress sheets,* showing the condition of the lock walls, accompany this report; also a hydrograph,* showing oscillation of the river for the past year.

The total amount expended on this improvement to June 30, 1898, is $319,454.84.

Money statement.

July 1, 1897, balance unexpended	$83,471.47
June 30, 1898, amount expended during fiscal year	67,176.31
July 1, 1898, balance unexpended	16,295.16
July 1, 1898, outstanding liabilities	557.83
July 1, 1898, balance available	15,737.33
Amount (estimated) required for completion of existing project	600,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Appropriations have been made as follows:

Act of September 19, 1890	$55,000
Act of July 13, 1892	125,000
Act of August 18, 1894	75,000
Act of June 3, 1896	75,000
Total	330,000

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*Not printed.

COMMERCIAL STATISTICS.

Articles.	1898.	1897.	1896.
Cotton ....tons..	16,250	7,800	8,350
Grain ....do...	....	5,525	4,420
Iron ....do...	....	95	92
Lumber ....do...	210,239	67,240	66,360
General merchandise ....do...	25,200	13,219	13,744
Coal ....do...	1,900	1,500	500
Total	253,589	95,379	93,466

(*c*) TOMBIGBEE RIVER FROM DEMOPOLIS TO COLUMBUS.

For the original condition of this work see pages 1443 and 1444, Annual Report of 1896.

PLAN OF IMPROVEMENT.

The plan of improvement is to obtain a channel 6 feet deep at low water and to maintain it by dredging and snagging.

For work done prior to June 30, 1897, see pages 1687 and 1688, Annual Report for 1897.

WORK OF THE PAST YEAR.

Snags removed	1,419
Logs cut up and removed	467
Sunken trees cut up and removed	283
Stumps blasted and removed	439
Logs and stumps on banks cut up	656
Overhanging trees felled	1,487
Trees trimmed	66
Bushes cut (estimated) ....cords..	828
Logs removed from drift piles	100
Piles driven, repairing jetties	255
Old jetties repaired ....linear feet..	90
Rock blasted, repairing jetties ....cubic yards..	611
Brush fascines, shore protection ....do....	53
Mattresses sunk for jetties ....square feet..	248
Gravel, sand, and clay excavated ....cubic yards..	1,507

The steam capstan snag boat *Noxubee* and the quarter boats *Pickensville* and *Fulton* are engaged in this improvement.

The condition of this section of the river on June 30, 1898, is such that light-draft boats can navigate it all the year on a slight rise above ordinary low water.

The total amount expended on this improvement to June 30, 1898, is $97,386.56.

Money statement.

July 1, 1897, balance unexpended	$67,687.70
June 30, 1898, amount expended during fiscal year	15,074.26
July 1, 1898, balance unexpended	52,613.44
July 1, 1898, outstanding liabilities	353.87
July 1, 1898, balance available	52,259.57
Amount (estimated) required for completion of existing project	2,000,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	500,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
September 19, 1890	$15,000
July 13, 1892	35,000
August 18, 1894	50,000
June 3, 1896	50,000
Total	150,000

(*d*) TOMBIGBEE RIVER FROM FULTON TO COLUMBUS.

For original condition of this work and for work done prior to June 30, 1897, see page 1689, Annual Report for 1897.

PLAN OF IMPROVEMENT.

The plan of improvement is to obtain high-water navigation by cutting overhanging trees and removing all obstructions above low water.

WORK OF THE PAST YEAR.

Snags removed		1,825
Sunken logs and trees removed		993
Stumps blasted and removed from river		592
Logs and stumps on banks cut up		2,092
Overhanging trees felled		5,260
Logs removed from drift piles		288
Fascines made	cords	16
Bushes cut (estimated)		1,060
Rock excavated	cubic yards	36
Piles cut and driven		120
Bank protected with piles, planks, clay, and gravel	linear feet	284

The original project was completed at a cost of $27,283.65.

The total amount expended in preservation of this improvement to June 30, 1898, is $17,263.04.

Money statement.

July 1, 1897, balance unexpended	$7,923.19
June 30, 1898, amount expended during fiscal year	7,186.23
July 1, 1898, balance unexpended	736.96
July 1, 1898, outstanding liabilities	36.70
July 1, 1898, balance available	700.26
Amount (estimated) required for maintenance of existing project	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	5,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made specifically for preservation of this section of the river:

By act of—	
July 13, 1892	$6,000
August 18, 1894	4,000
June 3, 1896	8,000
Total	18,000

COMMERCIAL STATISTICS.

Articles.	1898.	1897.	1896.
	Tons.	*Tons.*	*Tons.*
Pine, cypress, and oak logs	79,285	32,192	20,000

This includes the commerce from Walkers Bridge to Fulton.

(*e*) TOMBIGBEE RIVER FROM WALKERS BRIDGE TO FULTON.

The condition of this improvement on June 30, 1898, is such as to allow large rafts of logs and timbers to be brought downstream on a slight rise above ordinary low water.

For original condition of this work and for work done prior to June 30, 1897, see page 1690, Annual Report for 1897.

No work was done during the fiscal year ending June 30, 1898.

Money statement.

July 1, 1897, balance unexpended	$340.79
June 30, 1898, amount expended during fiscal year	5.00
July 1, 1898, balance unexpended	335.79
Amount (estimated) required for maintenance of existing project	1,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	1,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
August 11, 1888	$4,000
September 19, 1890	4,000
July 13, 1892 (maintenance)	3,000
August 18, 1894 (maintenance)	1,000
June 3, 1896 (maintenance)	1,000
Total	13,000

For commercial statistics, see report on Tombigbee River from Fulton to Columbus.

S 5.

IMPROVEMENT OF NOXUBEE RIVER, MISSISSIPPI.

For original condition of this work and for work done prior to June 30, 1897, see pages 1691 and 1692, Annual Report for 1897.

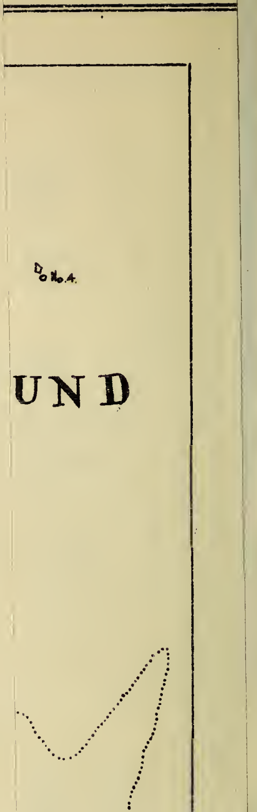
The river is navigable during high water to Macon, Miss.

No work was done during the past fiscal year and no expenses were incurred.

Money statement.

July 1, 1897, balance unexpended	$3,903.19
July 1, 1898, balance unexpended	3,903.19
Amount (estimated) required for maintenance of existing project	3,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	3,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.


No. 4
UND
Petit Bois I.
ICO
Thomas P. Brown

The appropriations made for this improvement are as follows:

By act of—	
June 14, 1880	$12,000
March 3, 1881	8,000
August 2, 1882	10,000
July 5, 1884	7,500
August 5, 1886	7,500
August 11, 1888	5,000
September 19, 1890	3,000
September 13, 1892 (maintenance)	3,000
August 18, 1894 (maintenance)	3,000
June 3, 1896 (maintenance)	3,000
Total	62,000

There is no commerce or navigation on this river.

S 6.

IMPROVEMENT OF PASCAGOULA RIVER, MISSISSIPPI.

For the original condition and history of this work, see pages 1448, 1449, and 1450 of Annual Report for 1896. For work done prior to June 30, 1897, see pages 1692, 1693, and 1694 of Annual Report for 1897.

During the past fiscal year no work has been done on either the channel or the river. The present depth on the bar at Horn Island Pass is 19.5. A sketch showing soundings taken June, 1898, accompanies this report.

The present condition of the river is such that vessels of 6½ feet draft can navigate to Cedar Creek, 55 miles above the mouth, all the year.

The total amount expended on this improvement to June 30, 1898, is $200,459.46.

Money statement.

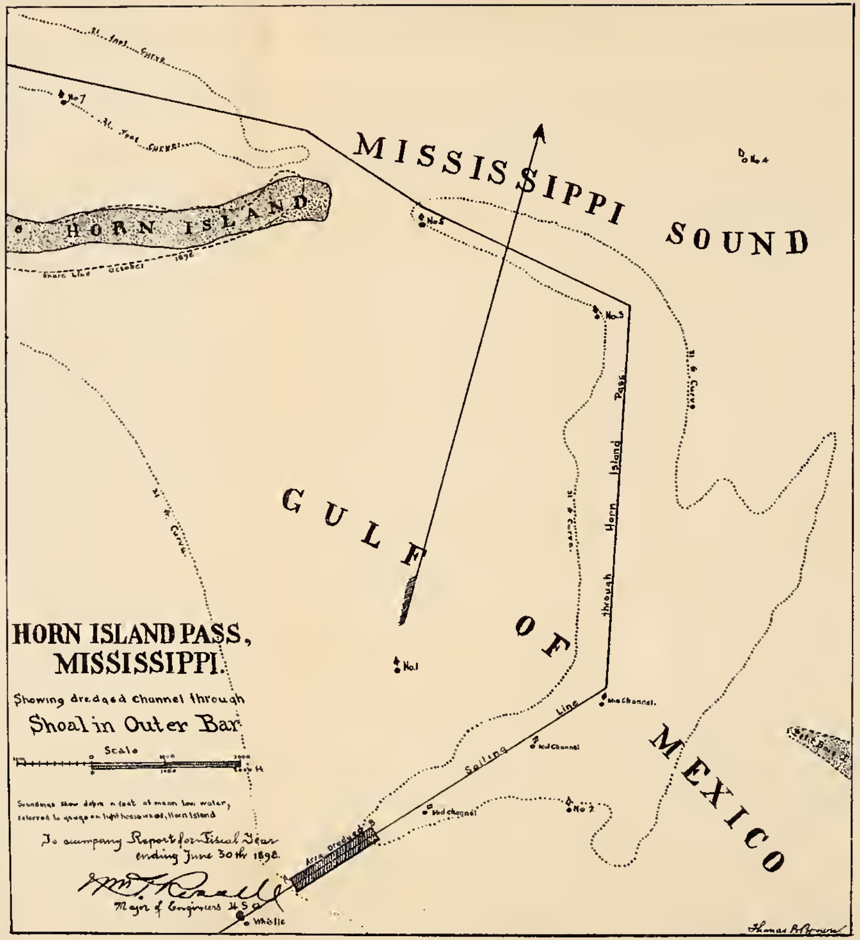
July 1, 1897, balance unexpended	$853.23
June 30, 1898, amount expended during fiscal year	812.74
July 1, 1898, balance unexpended	40.49
Amount (estimated) required for completion of existing project	42,185.42
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
March 2, 1827	$8,000
May 23, 1828	17,500
August 30, 1852	5,000
Total	30,500

By act of—	
June 17, 1878	10,000
March 3, 1879	14,000
June 14, 1880	20,000
March 3, 1881	4,000
August 2, 1882	8,000
July 5, 1884	3,000
Total	59,000



HORN ISLAND PASS, MISSISSIPPI.

Showing dredged channel through

Shoal in Outer Bar

Scale

Soundings show depth in feet at mean low water, referred to gauge on lighthouse wharf, Horn Island

To accompany Report for Fiscal Year ending June 30th 1898.

Wm. T. Rossell
Major of Engineers U.S.A.

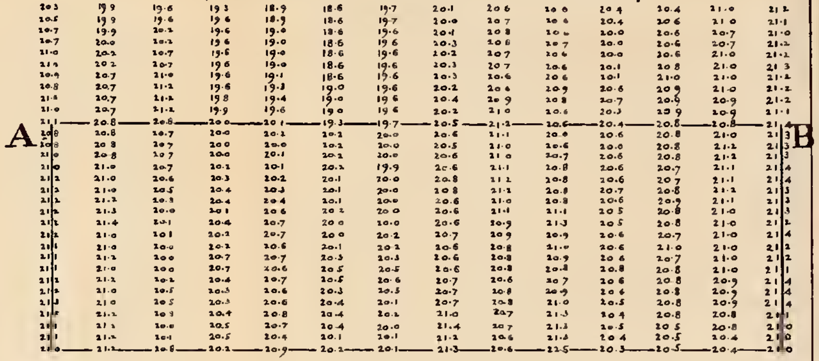
Soundings

showing condition of

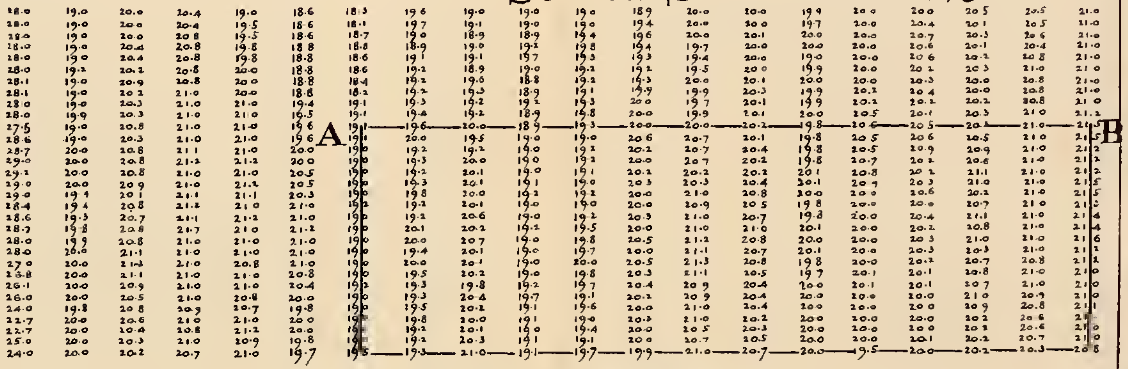
Outer Bar,

at completion of dredging operations, and at the present time.

Soundings made April 1897.



Soundings made June 1898.



Horizontal Scale 1 inch=166⅔ ft.
Vertical Scale 1 inch=83⅓ ft.

The appropriations made for this improvement are as follows:

By act of—	
June 14, 1880	$12,000
March 3, 1881	8,000
August 2, 1882	10,000
July 5, 1884	7,500
August 5, 1886	7,500
August 11, 1888	5,000
September 19, 1890	3,000
September 13, 1892 (maintenance)	3,000
August 18, 1894 (maintenance)	3,000
June 3, 1896 (maintenance)	3,000
Total	62,000

There is no commerce or navigation on this river.

S 6.

IMPROVEMENT OF PASCAGOULA RIVER, MISSISSIPPI.

For the original condition and history of this work, see pages 1448, 1449, and 1450 of Annual Report for 1896. For work done prior to June 30, 1897, see pages 1692, 1693, and 1694 of Annual Report for 1897.

During the past fiscal year no work has been done on either the channel or the river. The present depth on the bar at Horn Island Pass is 19.5. A sketch showing soundings taken June, 1898, accompanies this report.

The present condition of the river is such that vessels of 6½ feet draft can navigate to Cedar Creek, 55 miles above the mouth, all the year.

The total amount expended on this improvement to June 30, 1898, is $200,459.46.

Money statement.

July 1, 1897, balance unexpended	$853.23
June 30, 1898, amount expended during fiscal year	812.74
July 1, 1898, balance unexpended	40.49
Amount (estimated) required for completion of existing project	42,185.42
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
March 2, 1827	$8,000
May 23, 1828	17,500
August 30, 1852	5,000
Total	30,500

By act of—	
June 17, 1878	10,000
March 3, 1879	14,000
June 14, 1880	20,000
March 3, 1881	4,000
August 2, 1882	8,000
July 5, 1884	3,000
Total	59,000

By act of—	
August 5, 1886	$20,000
August 5, 1886, transferred amount appropriated for improving Horn Island Pass, act of July 5, 1884	5,000
August 11, 1888	27,000
September 19, 1890	20,000
July 13, 1892	20,000
August 18, 1894	13,000
June 3, 1896	6,000
Total	111,000

S 7.

IMPROVEMENT OF CHICKASAHAY RIVER, MISSISSIPPI.

For original condition of this work and for work done prior to June 30, 1897, see pages 1695 and 1696, Annual Report for 1897.

The condition of this improvement on June 30, 1898, is the same as it was on June 30, 1897, allowing for the annual accumulation of obstructions, etc. No work has been done during the past year, and there have been no expenditures.

The total amount expended on this improvement to June 30, 1898, is $16,970.96.

Money statement.

July 1, 1897, balance unexpended	$29.04
July 1, 1898, balance unexpended	29.04
Amount (estimated) required for completion of existing project	13,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	2,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	2,000
Total	17,000

S 8.

IMPROVEMENT OF LEAF RIVER, MISSISSIPPI.

For original condition of this work and for work done prior to June 30, 1897, see page 1697, Annual Report for 1897.

The project was virtually completed in 1897, but the river will have to be worked over from year to year to remove accumulations of obstructions.

On June 30, 1898, the condition of the river is such that light-draft boats can navigate from the mouth to Bowie Creek, 75 miles.

No work was done during the past fiscal year.

The total amount expended on this improvement to June 30, 1898, is $14,223,78,

Money statement.

July 1, 1897, balance unexpended	$896.68
June 30, 1898, amount expended during fiscal year	120.46
July 1, 1898, balance unexpended	776.22
July 1, 1898, outstanding liabilities	30.00
July 1, 1898, balance available	746.22
Amount (estimated) required for completion of existing project	10,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	5,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	2,500
June 3, 1896	2,500
Total	15,000

S 9.

IMPROVEMENT OF PEARL RIVER BELOW JACKSON, MISSISSIPPI.

For original condition of this work and for work done prior to June 30, 1897, see pages 1698, 1699, and 1700, Annual Report of 1897.

WORK OF THE PAST YEAR.

Work was continued on this section of the river with snag boats Nos. 1 and 2 from July 1 to August 28, 1897, when operations were discontinued on account of high water. The boats were laid up at Wakiah Bluff, Mississippi, where they have since remained in charge of a watchman.

The work accomplished during the year ending June 30, 1898, was as follows:

Snags removed	1,436
Logs and trees removed	228
Stumps blasted and removed from river	410
Logs and stumps on banks cut up	198
Drift piles removed	42
Logs removed from drift piles	85
Overhanging trees removed	6,007
Trees trimmed	4
Bushes cut, cords (estimated)	177½

The present condition of the river is such as to allow navigation by light-draft boats all through the year from the mouth to Monticello, Miss., 160¾ miles. From Monticello to Jackson, Miss., 151¼ miles, the river can be navigated only on a rise of 6 or 7 feet above low water.

The total amount expended on this improvement to June 30, 1898, is $147,299.29.

Money statement.

July 1, 1897, balance unexpended	$14,228.48
June 30, 1898, amount expended during fiscal year	3,402.77
July 1, 1898, balance unexpended	10,825.71
Amount (estimated) required for completion of existing project	40,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

The following appropriations have been made:

By act of—		By act of—	
June 14, 1880	$30,000	September 19, 1890	$20,000
March 3, 1881	25,000	July 13, 1892	15,000
August 2, 1882	15,000	August 18, 1894	5,000
July 5, 1884	10,000	June 3, 1896	10,000
August 5, 1886	13,125		
August 11, 1888	15,000	Total	158,125

S 10.

IMPROVEMENT OF PEARL RIVER BETWEEN CARTHAGE AND JACKSON, MISSISSIPPI.

For original condition of this work and for work done prior to June 30, 1897, see pages 1700 and 1701, Annual Report of 1897.

WORK OF THE PAST YEAR.

Work on this section of the river was continued from July 1 to September 22, 1897, covering a distance of 49 miles, and again from June 11, 1898, to the end of the fiscal year, covering a distance of 11 miles.

The work accomplished during the fiscal year ending June 30, 1898, is as follows:

Snags removed	15,664
Logs cut up and removed	2,319
Stumps in river blasted	967
Logs removed from drift piles	283
Logs and stumps on banks cut up	1,186
Overhanging trees felled	2,502
Trees trimmed	181
Bushes cut, cords (estimated)	6,045

The present condition of this section of the river is such as to admit of navigation by light-draft boats from Carthage to Jackson on a 3-foot rise above ordinary low water.

The total amount expended on this improvement to June 30, 1898, is $200,459.46.

This project is now completed, and future appropriations will be used in preservation of the improvement.

Money statement.

July 1, 1897, balance unexpended	$2,099.60
June 30, 1898, amount expended during fiscal year	1,467.40
July 1, 1898, balance unexpended	632.20
Amount (estimated) required for maintenance of existing project Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	2,500.00

The following appropriations have been made:

By act of—		By act of—	
March 3, 1879	$6,000	September 19, 1890	$3,000
June 14, 1880	7,500	July 13, 1892	5,000
March 3, 1881	2,500	August 18, 1894	2,400
August 2, 1882	2,500	June 3, 1896	2,400
August 6, 1886	2,250		
August 11, 1888	2,500	**Total**	**36,050**

COMMERCIAL STATISTICS.

Articles.	1898.	1897.	1896.
	Tons.	*Tons.*	*Tons.*
Cotton	30	50	300
Staves	150	200	270
Total	180	250	570

S 11.

IMPROVEMENT OF PEARL RIVER BETWEEN EDINBURG AND CARTHAGE, MISSISSIPPI.

For original condition of this work and for work done prior to June 30, 1897, see page 1702, Annual Report for 1897.

This project has been entirely completed, and the condition of the river on June 30, 1898, is such as to allow navigation by light-draft boats on a 4-foot rise.

No work has been done during the past fiscal year.

The total amount expended on this improvement to June 30, 1898, is $15,958.12.

Money statement.

July 1, 1897, balance unexpended	$293.00
June 30, 1898, amount expended during fiscal year	1.12
July 1, 1898, balance unexpended	291.88
Amount (estimated) required for maintenance of existing project. Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	1,000.00

The following appropriations have been made:

By act of—	
July 5, 1884	$2,500
August 5, 1886	2,250
August 11, 1888	5,000
September 19, 1890	5,000
July 13, 1892, maintenance	500
August 18, 1894, maintenance	500
June 3, 1896, maintenance	500
Total	16,250

There was no commerce on this river during the fiscal year.

S 12.

IMPROVEMENT OF BOGUE CHITTO, LOUISIANA.

For original condition of this work and for work done prior to June 30, 1897, see page 1703, Annual Report for 1897.

WORK OF THE PAST YEAR.

Work was continued from July 1 to September 23, 1897, covering a distance of 43¼ miles, and again from June 1, 1898, to the end of the fiscal year, covering a distance of 1 mile.

The work accomplished during the fiscal year ending June 30, 1898, is as follows:

Snags removed	1,142
Stumps in river blasted	222
Logs removed from river	257
Logs and stumps on banks cut up	55
Logs removed from drift piles	49
Overhanging trees felled	2,429
Bushes cut, cords (estimated)	3,110

The present condition of the stream is such as to admit of navigation for light draft boats and large rafts of logs and timber for a distance of 79¾ miles on a rise of 3 feet above ordinary low water.

The total amount expended on this improvement to June 30, 1898, is $18,696.47.

Money statement.

July 1, 1897, balance unexpended	$3,776.58
June 30, 1898, amount expended during fiscal year	2,473.05
July 1, 1898, balance unexpended	1,303.53
July 1, 1898, outstanding liabilities	6.89
July 1, 1898, balance available	1,296.64

Amount (estimated) required for completion of existing project	35,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—

September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	5,000
Total	20,000

COMMERCIAL STATISTICS.

Articles.	1898.	1897.	1896.
	Tons.	*Tons.*	*Tons.*
Saw logs and timber (pine)	8,457	6,720	6,750
Saw logs (cypress)	4,475	60	....
Total	12,932	6,780	6,750

S 13.

SURVEY FOR CANAL BETWEEN WARRIOR RIVER AND FIVE-MILE CREEK, ALABAMA.

The survey was begun August 14, 1897, and was carried on until February 28, 1898. Three parties were organized, two for topography, etc., and one for precise level work.

All field work was completed, and the maps and drawings are now being finished. They will be submitted early in the next fiscal year.

By act of June 4, 1897, the expenses of this survey were authorized to be paid from the unexpended balance of appropriation for improving Black Warrior River from Tuscaloosa to Daniels Creek.

APPENDIX T.

INSPECTION OF THE IMPROVEMENT OF THE SOUTH PASS OF THE MISSISSIPPI RIVER.

REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS, INSPECTING OFFICER, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING THERETO.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., July 2, 1898.

GENERAL: I have the honor to submit my annual report for the fiscal year ending June 30, 1898, upon the improvement of South Pass of the Mississippi River.

The construction work done during the year was altogether in maintaining the jetties and auxiliary works in an effective condition, and was not extensive.

During the year the required "channel having a navigable depth of 26 feet" was maintained through the shoal at the head of South Pass. For sixty-three days the channel in South Pass was less than 26 feet deep at three localities, viz, in Grand Bayou Reach, Goat Island Reach, and near the foot of Goat Island. During this interruption, which was due to large volumes of sand moving along the bottom, and at times augmented by unusually low tide, commerce was considerably impeded.

With the exception of four days the required channel was maintained "through the jetties" at the mouth of South Pass and beyond them to deeper water in the Gulf. The four days during which the channel was not maintained occurred during the period when the channel in the pass was deficient, and does not, therefore, increase the number of days deficiency, sixty-three days being the whole number during the year throughout the 14 miles of channel from the main river to the Gulf.

The area which is usually considered in determining what changes in depth are occurring beyond the ends of the jetties shows a slight deepening during the year.

During the year the dredge boat worked one hundred and fifteen days of ten hours each, as follows:

Five days in the channel beyond the ends of the jetties, fifty days in the jetty channel, and sixty days in the South Pass. The number of days of twenty-four hours each is forty-seven and two-thirds.

I would again invite attention to the importance of increasing the amount annually available for the expenses of examinations and surveys from $10,000 to $12,000, unless the unexpended balances which we have had for some years be made available for succeeding years.

Herewith I submit the report of Mr. C. Donovan, assistant engineer, with five charts and one plate to accompany the same.

The following are copies of certified statements which I made during the year upon which payments were made to the contractors:

United States inspecting officer's certificates for maintenance of channel at the mouth and head of South Pass of the Mississippi River, and also "through the pass itself," as designated by acts of Congress approved March 3, 1875 and 1879.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., September 27, 1897.

I certify that between the dates of May 14, 1897, and September 27, 1897, both dates inclusive, Estill McHenry and E. M. Switzer, the legal representatives of James B. Eads, deceased, maintained a channel "through the jetties at the mouth of South Pass of the Mississippi River, twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the same period a channel having "a navigable depth of twenty-six feet" was maintained through the shoal at the head of South Pass and "through the pass itself," except for forty-five days from May 25 to July 8, both dates inclusive, when the required channel was not maintained in that portion of "the pass itself" known as Grand Bayou Reach.

Depths were "measured at average flood tide."

JAMES B. QUINN,
Major, Corps of Engineers.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., December 27, 1897.

I certify that between the dates of September 28, 1897, and December 27, 1897, both dates inclusive, E. M. Switzer and Estill McHenry, the legal representatives of James B. Eads, deceased, maintained a channel for three months "through the jetties" at the mouth of South Pass of the Mississippi River, "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the same period a channel having "a navigable depth of twenty-six feet" was maintained through the shoal at the head of South Pass and "through the pass itself."

Depths were "measured at average flood tide."

JAMES B. QUINN,
Major, Corps of Engineers.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., May 18, 1898.

I certify that between the dates of December 28, 1897, and May 18, 1898, both dates inclusive, E. M. Switzer and Estill McHenry, the legal representatives of James B. Eads, deceased, maintained a channel for three months "through the jetties" at the mouth of South Pass of the Mississippi River, "twenty-six feet in depth, not less than two hundred feet in width at the bottom, and having through it a central depth of thirty feet without regard to width."

During the same period "a channel having a navigable depth of twenty six feet" was maintained through the shoal at the head of South Pass and "through the pass itself," except for fifty-two days, as follows: From December 30, 1897, to January 25, 1898, both dates inclusive, being twenty-seven days, the required channel was not maintained in that portion of "the pass itself" known as Grand Bayou Reach, and from April 23 to May 17, 1898, both dates inclusive, being twenty-five days, the required channel was not maintained in Goat Island Reach for a period of twenty days, nor in Grand Bayou Reach for a period of five days.

Depths were "measured at average flood tide."

JAMES B. QUINN,
Major, Corps of Engineers, United States Army.

Estimate of funds required for examinations and surveys at South Pass, Mississippi River, during the fiscal year ending June 30, 1900.

1 assistant engineer	$2,700
1 assistant engineer	1,500
1 steam engineer	1,200
1 water-level observer	60
5 seamen	3,320
Rent of office and quarters	300
Mileage and traveling expenses	150

Repairs to launch and boats	$400
Supplies for launch and office	300
Contingencies	2,000
Total	11,930

Money statement.

Amount allotted for fiscal year 1897–98, under act of August 11, 1888	$10,000
Amount allotted for fiscal year 1898–99, under act of August 11, 1888	10,000

Statement of expenditures on account of appropriation for examinations and surveys at South Pass, Mississippi River, for the fiscal year ending June 30, 1898, made in compliance with section 4 of river and harbor act of August 11, 1888.

Amount appropriated by act of August 11, 1888	$10,000

EXPENDITURES.

1 assistant engineer, 11–18.5/30 months, at $225	$2,513.81
1 assistant engineer, $11\frac{1}{2}$ months, at $125	1,437.51
1 engineer launch, 11–10.75/30 months, at $100	1,022.23
1 first-class seaman, $11\frac{8}{30}$ months, at $70	788.83
1 first-class seaman, 10–7.5/30 months, at $65	666.41
1 first-class seaman, 10–6.5/30 months, at $65	664.24
1 first class seaman, 9–18.5/30 months, at $60	577.14
1 water-level observer, 12 months, at $5	60.00
1 first-class seaman, 12 days, at $2.25	27.00
1 clerk, 1 month, at $125	125.00
1 stenographer and typewriter, 1 month, at $90	90.00
1 porter, 1 month, at $50	50.00
Rent of office and quarters, Port Eads, La., 12 months, at $25	300.00
Stationery, etc	49.25
Repairs to steam launch *General Reese*	512.18
Ship chandlery, hardware, etc	324.65
Coal	319.80
Traveling expenses and mileage	91.52
1 Whitehall boat	90.00
Total expenditures	9,709.57

Respectfully submitted.

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

REPORT OF MR. C. DONOVAN, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Port Eads, La., July 1, 1898.

SIR: I have the honor to report upon the improvement of the South Pass of the Mississippi River for the fiscal year ending June 30, 1898.

The work is carried on under the direction of Messrs. E. M. Switzer and Estill McHenry, of St. Louis, Mo., by authority granted them as the legal representatives of James B. Eads, deceased, in an act of Congress approved March 3, 1875. They are authorized "to construct such permanent and sufficient jetties and such auxiliary works as are necessary to create and permanently maintain, as hereinafter set forth, a wide and deep channel between the South Pass of the Mississippi River and the Gulf of Mexico," and to maintain said channel for a period of twenty years from July 8, 1879.

This report gives in detail the amount and character of the work done during the year, the present condition of the works, and the results of examinations and surveys.

The following charts accompany the report:

No. 1. Chart of the channel from South Pass Light-House through the jetties, to deeper water in the Gulf.

No. 2. Chart of a part of the Gulf of Mexico.

No. 3. Chart of a part of South Pass, from South Pass Light-House to Grand Bayou.

No. 4. Chart of a part of South Pass, from Grand Bayou to the Head of the Passes.

No. 5. Chart of the Head of the Passes.

Plate I. Diagram showing changes in the depth of the Gulf for each year from 1876 to 1898.

AT THE HEAD OF THE PASSES.

Upper dam.—During the month of April 39 feet of the west end of this dam was undermined and washed out. The remaining 470 feet was maintained in good condition during the year by additional piling, willows, stone, and earth in sacks.

The following materials were used in the maintenance of this dam during the year: 127 piles, 904 cords of willows, 1,046 cubic yards of stone, 1,493 linear feet of 12 by 12 inch timber, 120 screw bolts, and 3,918 sacks of earth.

West T-head.—This structure is the west jetty, at the head of South Pass. It was maintained during the year by the addition of 66 piles, 301 cords of willows, 1,065 linear feet of 12 by 12 inch timber, 75 screw bolts, and 610 sacks of earth.

East T-head extension.—At the upper end of this work two rows of piles were driven, one being 75 feet in length and the other 40 feet. The rows of piles were 8 feet apart, and willows, stone, and earth were placed between them. This work was done to protect the shore at that point. The following materials were used in the work: 21 piles, 121 cords of willows, 38 cubic yards of stone, and 120 sacks of earth.

Cut-off dike.—This dike, which has so effectually closed the waterway between the upper dam and the mainland below it, remained in good condition during the year. Materials were added to it, and for its protection two wing dams were built at right angles to it, one on the east side and one on the west side, being, respectively, 246 and 370 feet below upper dam, and are numbered 3 and 4. No. 3 is 150 feet long and 7 feet wide; No. 4 is 61 feet long and 9 feet wide. Each contains two rows of piles, between which willows weighted with earth in sacks are placed. These dams are considered a part of the dike. The following materials were used in this structure during the year: 57 piles, 478 cords of willows, 132 linear feet of 12 by 12 inch timber, 23 screw bolts, and 1,651 sacks of earth.

Mattress sills across Southwest Pass and Pass a Loutre.—No important change was noted in these structures during the year, and they are substantially as reported on page 1471 of the Report of the Chief of Engineers for 1896.

The locations of all works at the Head of the Passes are given on chart No. 5.

IN SOUTH PASS.

Of the four sheet-piling dams which were built in 1894 along the west banks of the pass below the Head of the Passes Light-House, only the uppermost one remains as originally built; two were washed out in 1896 and one during the present year.

In Goat Island Reach.—Each of the four wing dams which it is necessary to maintain in this reach were more or less repaired during the year and are in good condition. The following materials were used in their maintenance: 40 piles, 206 cords of willows, 377 linear feet of 12 by 12 inch timber, 53 screw bolts, and 218 sacks of earth.

In Grand Bayou Reach.—Of the nine wing dams now maintained in good condition in this reach six were repaired or added to during the year. The following materials were used in their maintenance: 193 cords of willows and 103 sacks of earth.

At two localities on the west bank of the South Pass 100 cords of willows, 801 sacks of earth, and 7 cubic yards of broken stone were used to build up the banks and prevent unusual overflow.

The locations of all dams in Goat Island and Grand Bayou reaches are given on charts 3 and 4.

AT THE MOUTH OF SOUTH PASS.

All the works referred to at this locality are represented on chart No. 1.

East jetty.—No work has been done on this jetty since 1893. Its condition is as follows: For 2,850 feet below East Point land has formed over and above it so that it is completely buried. For the next 3,360 feet it is as originally built of mattresses of willows ballasted with stone, and is from 1 to 3½ feet below the plane of average flood tide. The remainder of the jetty is capped by a concrete wall which was completed in 1889, except 304 feet, in two sections, of older construction, which, however, are not in place at present. This wall settles quite uniformly from year to year, the average yearly subsidence being 0.15 of a foot, and the average total subsidence is

1.4 feet. The wall is in fair condition; its upper surface averages 0.02 of a foot above the present plane of average flood tide, which is 4.1 feet on Port Eads guage.

The land formation east of this jetty continues to recede, the average recession during the year being 150 feet, in consequence of which 300 feet of the jetty was uncovered and exposed to the action of the sea.

West jetty.—Three hundred and eighty feet of the outer end of this work is from 2 to 5 feet below the surface of the water, and the remainder is, as represented on chart No. 1, below the surface of the land which has formed since it was built.

Inner east jetty.—In consequence of the recession of the land east of the main jetty the inner jetty was continued upstream to a point 3,280 feet below East Point, and piles are driven for a further extension of 580 feet. This continuation could not be made on the original line because of the land formation, so an offset of 50 feet was made at the lower end and the alignment made so as to meet the upper section of this jetty. But one row of piles is used in the extension; willows are placed against them and for a distance of 30 feet from them in such a manner as to form a slope toward the Gulf, and this slope is covered with stone.

At other localities the river row of piles in this jetty have been renewed, and willows and stone were added wherever the condition of the work most required them. The work is in fair condition, and the following materials were used in its maintenance: 475 piles, 4,556 cords of willows, 766 cubic yards of stone, and 150 sacks of macadam.

Inner west jetty.—A crib 481½ feet long, 9 feet wide, and 3 feet high was placed on this jetty, the upper end being at Dam No. 9. This was built in the usual way of 12 by 12 inch timbers driftbolted together, and is filled with stone.

Three rows of piles commencing 275 feet below the west light were driven parallel to the original line of the jetty, forming a section of work 117½ feet long and 13 feet wide. The piles in each row are connected by 12 by 12 inch timbers bolted to them, and willows and stone are placed between them. This is a part of the inner west jetty, but was built off the line of that work because of the débris which prevented keeping the line.

The river row of piles has been renewed for a distance of 460 feet, mostly between Dams 30 and 48.

The following materials were used in maintaining this jetty during the year: 135 piles, 865 cords of willows, 120 cubic yards of stone, 4,870 linear feet of 12 by 12 inch timber, 781 linear feet of 2 by 12 inch plank, 742 linear feet of coal-boat gunwales, 93 screw bolts, and 909 driftbolts.

Wing dams.—Two wing dams were built during the year, making thirty-six of these structures which are maintained in good condition. The new dams are Nos. 49 and 50. They are 47 and 52 feet long, respectively, and 11 and 10½ feet wide. They are constructed in the usual manner of two rows of piles, between which willows and stone are placed. The piles in each row are connected by a 12 by 12 inch waling timber bolted to them, and ties of the same material prevent the rows from spreading. Of the older dams eight were more or less repaired.

Four cribs were placed on the dam which connects the outer ends of the east jetty and the inner east jetty. Three of them are 27 by 15 by 5 feet and one 27 by 24½ by 5 feet.

The following materials were used in the construction and maintenance of wing dams: Fifty-nine piles, 416 cords of willows, 480 cubic yards of stone, 8,316 linear feet of 12 by 12 inch timber, 1,956 linear feet of 2 by 12 inch plank, 94 screw bolts, and 1,488 driftbolts.

DREDGING.

From June 22, 1897, to June 21, 1898, both dates inclusive, the dredge boat worked one hundred and fifteen days of ten hours each, as follows: Sixty days at three localities in South Pass, fifty days in the jetty channel at the mouth of South Pass, and five days in the channel beyond the ends of the jetties.

In this connection, and because comparisons have been made between the number of days during which dredging was and was not done by using the number of days of ten hours each, I would state that such comparison is not equitable. A comparison can only be made by reducing the time during which dredging was done to days of twenty-four hours each. For the year ending June 21, 1898, this comparison is as follows:

Number of days during which the channel was maintained by jetties and auxiliary works other than dredging, three hundred and seventeen and one-third. Number of days during which the channel was maintained by dredging, forty-seven and two-thirds. From this it follows that one day's dredging in every seven and seven-tenths days was done.

THE PLANT.

Repairs were made to the dredge boat, a tug, launch, two barges, and a wharf rebuilt.

FORCE EMPLOYED.

The average force employed during the year, including all grades, was 44 in number.

EXAMINATIONS AND SURVEYS.

The most important results of examinations and surveys made during the year are given graphically or tabulated herein, and as methods which have been used for many years are still adhered to, the results will be readily understood by those familiar with these reports.

The table which follows is a continuation of that given on page 1737 of the Report of the Chief of Engineers for 1897:

Number days during which channel was maintained. (Full quarter.)	Periods which include a full quarter and the number of days during which the channel was not maintained.		Number of days deficiency, and locality of same.			Stage of river at Carrollton, La.
	From—	To—	In South Pass.	In Jetty Channel.	In Gulf of Mexico.	
5,841	Total up to March 12, 1896		47	164	40	
92	Mar. 12, 1896	June 28, 1896	5	12		11.9 to 4.7 to 10.
92	June 29, 1896	Jan. 28, 1897		122		7 to 0.7 to 3.9.
90	Jan. 29, 1897	May 13, 1897		11	4	6 to 19.
92	May 14, 1897	Sept. 27, 1897	45			19 to 2.6 to 3.9 to 0.9.
91	Sept. 28, 1897	Dec. 27, 1897				2 to 0.5.
90	Dec. 28, 1897	May 18, 1898	52			1 to 14 to 6 to 16.
6,388	Total		149	309	44	

Number of days from July 8, 1879, to May 18, 1898, both dates inclusive	6,890
Number of days in this period during which a legal channel was not maintained	502
Number of days during which a legal channel was maintained	6,388=17½ years.

AT THE HEAD OF THE PASSES.

The chart of this survey is No. 5. The area which this survey embraces may be said to have assumed a normal condition. From year to year there are changes dependent upon and influenced by the stage of the river, and there are occasional abnormal conditions which cause sudden, though temporary, changes, but the interruptions to a deep channel have been so slight since it was first obtained, in 1879, that up to the present time it may be said that the improvement in depth, from 13 feet in 1875 to the present wide and deep channel, has been permanent. As a rule this area deepened during the year, but the change was unimportant.

Details as to the depth of the channel can be best obtained from a study of chart No. 5. At present the channel is deeper than shown on the chart, but as the survey was made during low river it gives more nearly a normal channel for the year, since there is practically no change in the depth of the channel during the low stage of the river, and that stage is of longer duration than any other.

SURVEY OF SOUTH PASS, FROM ITS HEAD TO SOUTH PASS LIGHT-HOUSE.

The charts of this survey are Nos. 3 and 4. The survey was made during the month of November, 1897, while the river was low. The following table gives the depth and width of channel in the different reaches:

Tabulated statement of the depth and width of channel throughout South Pass of the Mississippi River, from East Point to 30 feet depth in the main river, given in separate reaches one-fourth of a mile in length, from a survey made iu November, 1897.

Locality.		Available depth.	Available width of—	
From—	To above East Point.		26-foot channel.	30-foot channel.
East Point	¼ mile	31	240	60
Above East Point:				
¼ mile	½ mile	31	270	110
½ mile	¾ mile	27	255	(*c*)
¾ mile	1 mile	29.5	230	(*d*)
First mile		27	230	.....
1 mile	1¼ miles	29	190	(*e*)
1¼ miles	1½ miles	30	245	.....
1½ miles	1¾ miles	26	325	(*f*)
1¾ miles	2 miles	27	343	(*g*)
Second mile		27	190	.....
2 miles	2¼ miles	28	360	(*h*)
2¼ miles	2½ miles	28	332	(*i*)
2½ miles	2¾ miles	30	390	.....
2¾ miles	3 miles	30	370	100
Third mile		28	332	.....
3 miles	3¼ miles	30	310	105
3¼ miles	3½ miles	30	270	50
3½ miles	3¾ miles	29	270	(*k*)
3¾ miles	4 miles	30	290	30
Fourth mile		29	270	.....
4 miles	4¼ miles	31	295	105
4¼ miles	4½ miles	29.5	340	(*m*)
4½ miles	4¾ miles	31	295	140
4¾ miles	5 miles	34	255	155
Fifth mile		29.5	255	.....
5 miles	5¼ miles	29	260	(*n*)
5¼ miles	5½ miles	27	207	(*o*)
5½ miles	5¾ miles	27	127	(1)
5¾ miles	6 miles	27	100	(2)
Sixth mile		27	100	.....
Above East Point:				
6 miles	6¼ miles	27	100	(3)
6¼ miles	6½ miles	28	300	(4)
6½ miles	6¾ miles	28	290	(5)
6¾ miles	7 miles	32	385	210
Seventh mile		27	100	.....
7 miles	7¼ miles	27	350	(6)
7¼ miles	7½ miles	29	305	(7)
7½ miles	7¾ miles	33	343	250
7¾ miles	8 miles	35	305	230
Eighth mile		27	305	.....
8 miles	8¼ miles	31	320	200
8¼ miles	8½ miles	31	337	215
8½ miles	8¾ miles	33	383	185
8¾ miles	9 miles	35	253	183
Ninth mile		31	253	.....
9 miles	9¼ miles	34	250	130
9¼ miles	9½ miles	29	350	(8)
9½ miles	9¾ miles	38	370	300
9¾ miles	10 miles	50	312	270
Tenth mile		29	250	.....
10 miles	10¼ miles	36	320	275
10¼ miles	10½ miles	39	330	255
10½ miles	10¾ miles	42	345	270
10¾ miles	11 miles	32	335	135
Eleventh mile		32	320	135
11 miles	11¼ miles	41	(*a*)	335
11¼ miles	11½ miles	32	(*a*)	250
11½ miles	11¾ miles	30	(*a*)	380
11¾ miles	12 miles	(*b*)	(*b*)	(*b*)
Twelfth mile		.....	.....	.....

a Very wide.
b In Mississippi River, above Head of the Passes.

	Feet.
(*c*)	1,320
(*d*)	220
(*e*)	335
(*f*)	1,003
(*g*)	1,320
(*h*)	1,320
(*i*)	210

	Feet.
(*k*)	1,100
(*m*)	230
(*n*)	490
(*o*)	1,320
(1)	1,320
(2)	1,320
(3)	1,320

	Feet.
(4)	1,110
(5)	750
(6)	425
(7)	280
(8)	250
Total	15,643

In the 12 miles of channel included in the above table there is 1.37 miles more which has a central depth of 30 feet than there was in September, 1896. This indicates a deepening, and it is general throughout the pass, although it is not marked, and it is a result naturally to be expected from the effect of the high river of 1897.

At three localities in the pass temporary shoaling occurred at times, which reduced the depth to less than that required by law, which is "a navigable depth of 26 feet." Such shoaling occurs about the time the river reaches its highest stage or when it begins to fall, then it is that large volumes of sand move along the bottom, and at times obstruct the channel.

From December 28, 1897, to January 25, 1898, both dates inclusive, being twenty-seven days, the channel was less than 26 feet in depth. This shoal was caused by the grounding of a steamer which was brought down the pass at a time when the tide was so low that the depth of water was not sufficient to float her. She was floated with the assistance of two powerful tugs after many hours work, and the force of their propellers, together with that of the steamer, caused a movement of sand which formed a barrier across the pass, and on which other steamers grounded.

The dredge boat was undergoing repairs at the time and did not get to work until January 17, and on the 26th the channel was clear again.

From July 1 to 6, 1897, both dates inclusive, being six days, and from April 28 to May 17, 1898, both dates inclusive, being twenty days, the channel in Grand Bayou Reach was less than 26 feet in depth, as was also the channel in Goat Island Reach from April 23 to May 12, 1898, both dates inclusive, being twenty days.

From May 28 to 30, both dates inclusive, being three days, a similar deficiency obtained in the channel near the lower end of Goat Island.

There were, therefore, sixty-three days during the fiscal year when a channel having "a navigable depth of 26 feet" was not maintained in South Pass.

From April 23 to May 18, the river had reached its highest stage, 15.8 feet on Carrollton gauge, and began to fall slightly; then it was that large volumes of sand which caused these shoalings were moving through the pass. At one time, in Goat Island Reach, dredging made no impression in removing the shoal as the sand came in faster than it could be taken out.

At present the river is falling, the movement of sand along the bottom has about ceased, and the channel throughout the pass is good.

THE CHANNEL THROUGH THE JETTIES.

The channel through the jetties and beyond them to deeper water in the Gulf is shown on chart No. 1. It is required that this channel be maintained "26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width." Such channel was maintained during the year except for four days from April 25 to 28, both dates inclusive, when, as a result of the movement of sand along the bottom, the central depth was less than 30 feet for a distance of 120 feet. This was corrected by the action of the current alone, and the channel has continued to improve.

The table which follows will explain the changes in the channel from month to month during the year, and chart No. 1 gives full details as to its present depth and width:

Available depths and widths of channel through the jetties, in separate reaches of 2,000 feet each, according to surveys made during the fiscal year ending June 30, 1898.

Date.	Distances from East Point, in feet.								
	0 to 2,000.			2,000 to 4,000.			4,000 to 6,000.		
	Available depth.	Available width of channel.		Available depth.	Available width of channel.		Available depth.	Available width of channel.	
		26 feet.	30 feet.		26 feet.	30 feet.		26 feet.	30 feet.
1897.									
July	30.8	275	80	31.6	310	185	33.1	275	200
August	31.3	240	60	30.9	290	140	33	280	180
September	30.1	230	12	31	260	41	31.6	233	118
October	30.4	202	20	30.3	264	46	30.5	227	90
November	30.9	220	25	30.5	244	33	31	220	56
December	31.5	255	30	31.4	280	60	31.3	242	80
1898.									
January	31.3	222	30	30.7	276	43	30.4	232	78
February	30.5	270	80	30.6	290	100	30.7	230	110
March	......	......	......	......	......	......	......	......	......
April	31.6	300	155	32.5	285	190	30.7	260	35
May	33	320	160	34	310	210	34	270	200
June	32.6	335	152	33.5	315	230	34.3	265	195

Available depths and widths of channel through the jetties, in separate reaches of 2,000 feet each, according to surveys made during the fiscal year ending June 30, 1898—Cont'd.

Date.	Distances from East Point, in feet.								
	6,000 to 8,000.			8,000 to 10,000.			10,000 to 12,000.		
	Available depth.	Available width of channel.		Available depth.	Available width of channel.		Available depth.	Available width of channel.	
		26 feet.	30 feet.		26 feet.	30 feet.		26 feet.	30 feet.
1897.									
July	35	250	180	35	240	200	34	265	200
August	35.3	260	180	35.7	250	180	32.2	290	190
September	30.7	213	162	32.5	235	166	30.5	249	140
October	31.7	216	92	34	227	160	31.3	260	142
November	30.8	215	85	33.4	218	156	32.2	220	170
December	32	222	98	32.9	235	160	32.4	245	152
1898.									
January	31.7	222	130	32.7	236	165	32.4	239	168
February	30.7	248	115	32.8	230	135	32.5	255	170
March									
April	*a* 30.3	260	45	34.3	255	185	32.2	270	190
May	34	270	180	32	245	170	33	270	185
June	34.1	252	206	37.1	280	195	34.7	320	200

a Less than 30 feet from April 25 to 28, both inclusive.

No more complete record of the changes in the depth of the jetty channel during twenty-three years can be given than is contained in the following table, which I have given each year because of its value and convenience, being a continuous record.

Table giving the depths of water through the jetties at various dates.

Date.	Distances from East Point, in feet.					
	0 to 2,000.	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1875—June	22.5	18.7	16.7	10.2	9.7	9.2
1876—May	23.3	20.3	22	21	17.1	15
August	23.5	19.6	21	23.5	23	19.8
November	22	20.3	21.1	21.2	21.1	20.3
1877—March	24.1	21.1	23.2	22	21.2	20.5
July	24.9	24	26	23.8	23.5	20.3
October 25 to December 14	26.3	24.4	28.5	24.2	23	23.7
1878—March	26	25.9	35.5	25.4	24.3	23
December	28.4	26.4	35.7	27.1	25.3	23
1879—March	28.6	27.5	43.4	27	27	27
June	27.5	28.4	47.7	29.2	29.2	28
July 8	30.5	30.7	....	31	30.7	30.5
December	31	31	48.3	31.7	31.8	30.8
1880—June	31	32.5	47.8	31.4	35.1	32
July	30.5	31	44	30.8	31.5	30.5
August	30.5	30.4	46	32	32	30.5
September	30.7	31	44.4	30.6	32	31
October	31	31.5	41	30.3	31	30.5
November	30.6	31	40.3	30.8	30.9	30.5
December	30.9	30.6	43	30.8	31	30.3
1881—January	30.5	30.4	41.9	33.8	30.7	30.3
February	30.4	30.2	41.6	32	31	30
March	31.5	31.2	41.3	32	32	30.5
April	30.4	30	43	33	33	30.5
May	30.2	30.5	42.7	32.6	30.5	31.2
June	30	30.5	43.8	32	31.7	31.7
July	31	32	42.5	33.5	33	32
August	30.1	32	37.6	32	31	30.2
October	30.2	30.3	38.3	31.4	31.2	30.3
1882—January	30.5	30.4	41.3	31.1	30.2	30.7
February	31.8	36	39.7	30.5	30.8	30.2
March	31.2	30.6	39.2	30.8	31.6	32.5
April	31.7	32.6	39.6	30.5	30.3	33
May	30.5	32.5	39.4	31	31.3	31
June	30.8	35.5	39	31.3	31.3	31
July	30	32.7	38.7	30.6	31.3	31.5

Table giving the depths of water through the jetties at various dates—Continued.

Date.	Distances from East Point, in feet.					
	0 to 2,000.	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1882—August	30.3	32.2	38.1	31.8	31.8	30.5
September	30.1	31.5	38.3	31.9	30.8	30.5
October	30	31	37.1	31	31.4	31.2
November	30	32	38.1	21.5	31.2	31.2
December	31	31	37	31.2	31	30.4
1883—January	31	31	35.2	30.2	30.1	30.1
February	31.2	31.2	36	30.5	30	30.1
March	32.3	32.6	45.7	31.5	30.3	30.3
April	33.7	35	44	32.2	30	39
May	33.2	36.3	46	32.3	30.3	32.4
June	32.5	34.2	45	33.4	31	33
July	33.8	34.9	44	32	31.5	31.8
August	32.1	38.2	48	33.4	33.4	32.2
September	33.4	34.3	46	32.3	32.3	30.6
October	32.7	34.1	41.5	32	32	30.5
November	31	33.8	43.8	34.5	31.5	31
December	30.5	32.6	43	31.6	31.6	30.2
1884—January	31.2	32.2	39.2	32.7	31.8	30.3
February	32	31.5	41.3	31.6	31	30.7
March	35.7	39.5	41.6	34	33.8	38.7
April	35.3	37.3	41.5	31.7	32.7	35.4
May	34.9	35.8	42.3	34.3	35.1	33
June	35	35.8	41.1	34	35	35
August	31.9	35.8	41.9	33.9	35	32
September	32	34	39	33.1	33.7	33.5
October	31.1	33.4	38.6	32.6	32.6	32.5
November	32.8	32.8	37.2	32.2	32.4	30.8
December	31.6	32.6	37.1	31.1	31.5	31.4
1885—January	36.7	36.4	36.9	33.1	34.6	32.8
February	41.7	36.3	35.7	30.5	34.1	36.2
March	35.5	36	36.1	31	31.7	35.7
April	36	35.5	37	32	32.6	32
May	36.7	35	35.6	31.5	33.5	31.5
June	34.7	33.7	35.7	32.8	32.8	31.3
July	36.3	33.1	36.5	33.7	33.6	31
August	36.5	35.6	37.6	33	32	31
September	35.3	33.3	35.2	32.2	30.7	31.7
October	33.8	33.7	35.8	31.3	30.4	30.4
November	32.7	32.8	35.1	30.8	30.6	30.1
December	33	32.2	34.2	30.9	30.5	30.6
1886—January	33.6	32.5	33	30.2	30.2	28.5
February	32.8	32.8	34.1	31.3	30.9	30
March	32.8	35.8	34	35	33.1	32
April	35.4	34.5	34.5	33.7	33.7	31
May	35.9	35.6	34.2	31	36	34.4
June	38.2	35.2	33.4	33.2	34.5	36.5
July	36.7	36.7	36.2	32.8	32.7	37
August	35	36	35.7	34.8	33.8	34.7
September	34.5	35.6	34.6	33.7	33.6	33
October	35	36.2	34.4	33	34.1	33
November	34.5	35.6	34.8	32.9	33	33.5
December	34	35	35.3	33.6	32.6	33
1887—January	33.6	34	33.3	32.3	32.7	33.4
February	36.4	34.4	35.4	31.3	34.1	32.4
March	35.5	35.5	32.6	35.5	35.5	33.8
April	38.8	37	33.7	31	34.8	35.5
May	39.4	35.3	37.1	31.2	34.2	38.1
June	39	35.4	37.5	32.3	34.1	35.2
July	39	36.4	35.8	34	32	34
August	35.7	34.6	34.7	33.6	31.6	32.7
September	36	34	35	35	32.7	32.2
October	36.2	34.2	34.3	32.1	32.2	31.8
November	35.9	32.9	33.8	30.7	31.8	31.2
December	34.7	32.7	33.9	30.9	31.7	31.8
1888—January	35.6	32.5	33.7	30.5	31.5	32.2
February	34.3	32.4	32.5	31	31	32
March	34	33	32.6	30.5	31.3	30.9
April	36.3	34.8	33.8	31	35	31.4
May	35.2	35.2	34.3	31.6	33.6	33
June	32	33	33	31.4	35.5	33.2
July	34.2	34	33.8	31	31.9	33.6
August	33.7	33.7	33.7	31.2	31.2	33.2
September	32.7	32.7	32.8	30.8	31	32
October	33.3	33.3	32.3	30.6	30.4	30.4
November	31.8	32.8	31.7	30.6	30.6	30.8
December	31.4	32.4	31.6	30.3	*a* 29.2	30.7

a From December 28, 1888, to January 4, 1889, inclusive.

Table giving the depth of water through the jetties at various dates—Continued.

Daee.	Distances from East Point, in feet.					
	0 to 2,000.	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1889—January	31	31.3	30.6	30.3	31	30.9
February	32.4	32.5	31.8	32.8	31	32.5
March	30.2	32.2	30.4	32.3	31.8	31.6
April	30.8	32.1	31.2	32.8	32.8	30.6
May	30.8	32	30.7	32.6	31.2	30.8
June	30.4	32.2	31.3	31.5	31	30.8
July	30.3	31	31	32.4	31.3	31
August	31.7	31.4	31.5	31.6	31.4	31
September	30.9	31.3	31.2	31	31.1	....
October	31.6	31	31.2	31	31.7	*a* 29.6
November	31	31.2	31.2	31	31.3	31.4
December	30.8	31	31.2	31	31.7	31.2
1890—January	30.8	30.8	31.2	30.6	31	31
February	31.7	30.7	31.5	32.6	34.4	33
March	36.4	33.2	34	34	34	33.6
April	33.4	36	35	35	38.7	34.5
May	32	34	34	36	39	34
June	32	33.5	33	34	39.8	35
July	32.4	33.4	34	34	39	37
August	32	33	33	32.7	35	34
September	30.5	31.4	33	33	35	33
October	32	31	31	30.5	34	32.8
November	30.6	31.2	30.6	30.6	34	33
December	31.5	31.2	30.7	30.7	32.3	33.5
1891—January	31	31	31.2	32.2	32.3	32.5
February	31.7	31	31.4	32.5	35.2	32.7
March	32	34.3	36.4	37.5	36	34.6
April	30.5	32	36.5	39	36.4	34.2
May	30.3	32	32	35	36	34
June	33	31.1	32	34.7	37	35
July	31.4	30.4	30.4	33.3	35.8	34.8
August	31	31	31	32.3	32.9	31.4
September	30.6	30.6	30.7	31	31.5	....
October	31	30.8	30.8	31.2	31.2	30.7
November	31.2	31	31.3	31.2	31.1	30.6
December	30.1	30.3	30.6	31.4	31.3	32
1892—January	31.3	31.6	31.3	31.3	31.8	32.2
February	30.5	30.8	30.8	31	31.1	31.7
March	30.8	30.7	31.4	31.7	31.2	31
April	32	32	33.7	32	30.5	30.6
May	*b* 28.1	*d* 29.6	38	35	33	32
June	*c* 30.4	32.3	36	37	36.6	33.2
July	31.5	33	32	35.6	38	34.2
August	31.5	33.5	33.8	34.6	34.8	35
September	31.2	32.7	31.2	33.6	33.7	33.5
October	31.8	32.5	31.8	31.5	32.7	32.3
November	31.5	32.1	31.5	32	33	32.6
December	31	31.5	31.6	32.1	33.5	33.1
1893—January	31.6	32.2	31.3	32.1	32.2	34.1
February	31.6	31.6	31	31.6	32.7	34
March	33.6	34.6	33.1	30.8	31.2	32 4
April	33.6	35	33.6	31.6	32.3	32.6
May	32	34	33	33	32.5	32
June	32.7	33	33.8	36	31.7	30.5
July	32	33.3	34	35	36.7	35
August	32	32	34	34.5	35.3	34.2
September	31.5	31.5	32.4	33.5	35.3	31.8
October	31.5	32.2	32.7	33.2	34.2	33.2
November	31.4	32.7	33.3	32.8	34.3	33
December	31	32	33	33	34.8	33.5
1894—January	32.1	32.1	33.5	33.2	36.8	34.5
February	30.6	32.2	32.6	32.6	34.5	33
March	32.8	31.8	31.7	32	34.2	34
April	34.3	31.4	32.7	33	32.3	34
May	32	32	34	34	34	33
June	32.2	31.2	32.9	33	32.7	33.6
July	32.1	31.6	31.7	31.5	31.8	32.6
August	31.2	30.5	31.2	30.2	*e* 28.9	30.3
September	31.3	30.6	30.6	30.5	30.3	30.5
October	30.4	30.4	30.1	30.8	30.6	30.4

a From October 1 to October 5, inclusive.

b Depth less than 30 feet from April 25 to May 6, both dates inclusive, and varied from 27.5 to 29.4 feet.

c Depth less than 30 feet from May 20 to June 20, both dates inclusive, and varied from 28.1 to 29.6 feet.

d From December 28, 1888, to January 4, 1889, inclusive.

e August 20 to 31, both dates inclusive.

Table giving the depths of water through the jetties at various dates—Continued.

Date.	Distances from East Point, in feet.					
	0 to 2,000.	2,000 to 4,000.	4,000 to 6,000.	6,000 to 8,000.	8,000 to 10,000.	10,000 to 12,000.
1894—November	30.3	30.3	30.6	30.3	30.3	30.8
December	30.8	30.6	31.3	30.7	30.7	30.7
1895—January	31.7	32.1	32.1	31.6	31.5	31.9
February	31.9	32.4	31.7	31.8	31.8	31.8
March	32.8	32.1	31.6	31.6	31.7	32.2
April	32	31.9	31.5	31.6	31.8	32.2
May	31.4	31.5	31.4	31.4	31.9	31.6
June	31.1	31.7	31.6	31.3	31.3	31.5
July	31.7	31.7	32	31.5	31.8	32.1
August	32.2	31.8	31.8	31.3	31.1	31.4
September	31.8	31.7	31.8	31.4	31.4	31.4
October	30.9	30.9	31.8	31.3	31.5	31.2
November	31.7	31.5	31.8	31.3	32.1	32.1
December	31 3	31.4	38.1	31.4	31.9	31.2
1896—January	31.3	30.9	32.1	31.9	31.3	32.4
February	31.3	31.1	31.3	31.3	31.5	31.5
March	30.6	30.3	30.5	31.1	32	32
April	30.5	30	30.3	30.4	31	31.9
May	30.3	30	30.2	30	31	32.4
June	30.2	30.2	[a] 30.2	[a] 30.2	[a] 30.2	32.2
July	30.3	30.7	30.4	30.4	31.1	31.1
August	[b] 29.3	29.3	[b] 29	[b] 29	[b] 29.4	30.2
September	30.2	29.4	30.3	29	29.9	30.1
October	30.2	30.3	30.6	30.5	30.4	30.2
November	30.8	30	30	30.4	30.3	30.4
December	30.7	30.7	31.1	30.8	30.9	31.1
1897—January	30.4	30.5	31.2	30.5	30.4	30.6
February	30	30.2	30	30	30.2	31
March	30.5	30.4	30	30.3	30.6	31.8
April	[c] 30.5	30.6	31.4	31.6	32.2	33.1
May	32	32	32	33	35	34
June	30.4	31.7	33.2	35	36	39
July	30.8	31.6	33.1	35	35	34
August	31.3	30.9	33	35.3	35.7	32.2
September	30.1	31	31.6	30.7	32.5	30.5
October	30.4	30.3	30.5	31.7	34	31.3
November	30.9	30.5	31	30.8	33.4	32.2
December	31.5	31.4	31.3	32	32.9	32.4
1898—January	31.3	30.7	30.4	31.7	32.7	32.4
February	30.5	30.6	30.7	30.7	32.8	32.5
March	....	....	....	....	....	....
April	31.6	32.5	30.7	[d] 30.3	34.3	32.2
May	33	34	34	34	32	33
June	32.6	33.5	34.3	34.1	37.1	34.7

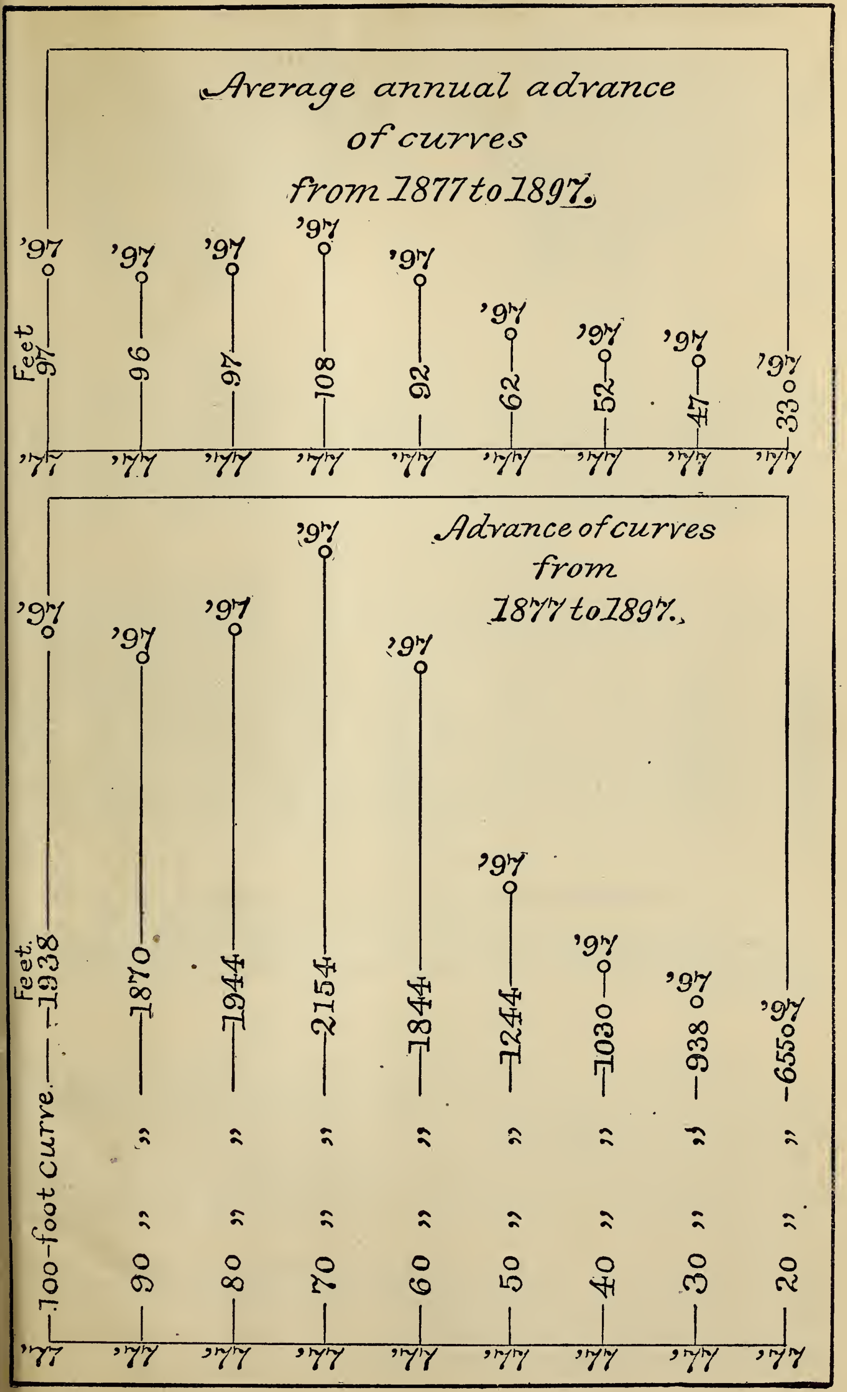
[a] Less than 30 feet from June 15 to 18, both inclusive.
[b] Less than 30 feet from August 17 to October 21, both inclusive.
[c] Less than 30 feet from April 16 to 20, both inclusive.
[d] Less than 30 feet from April 25 to 28, both inclusive.

SURVEY BEYOND THE ENDS OF THE JETTIES.

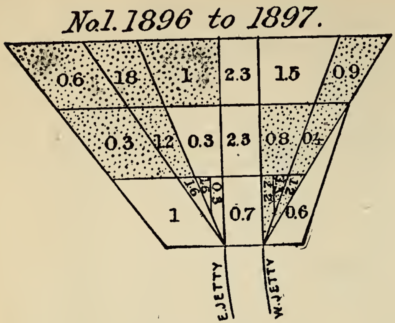
The chart of this survey is No. 2. Referring to Plate I, it will be seen that the 30, 40, and 60 foot curves receded during the year and the others advanced, although that of the 20 and 50 foot curves was very slight. This indicates a deepening inside of the 70-foot curve and a shoaling farther out than that depth, giving evidence that at times a sufficient force of current is maintained after the water is discharged between the ends of the jetties to prevent the heavier sediment from being deposited immediately in front of the jetties.

The following diagram gives the distance that each curve has advanced since 1877 and the average annual advance of each. As heretofore, the 70-foot curve shows the greatest advance and the 20-foot curve the least.

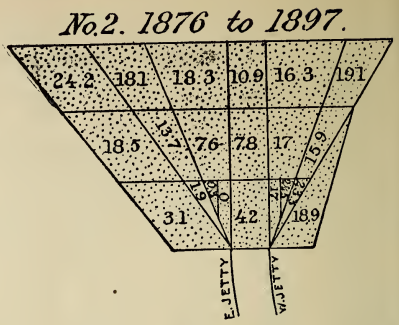
To note the distribution of shoaling or deepening beyond the ends of the jetties is an interesting study. For this purpose I divide an area containing 1¼ square miles into 21 lesser areas and determine the deepening or shoaling in each, and finally over the whole area by comparing the mean depth with similar results for former years.


Average annual advance of curves from 1877 to 1897.
Feet
'97
'77
97
96
97
108
92
62
52
47
33
Advance of curves from 1877 to 1897.
Feet.
100-foot curve.—1938
90 " " 1870
80 " " 1944
70 " " 2154
60 " " 1844
50 " " 1244
40 " " 1030
30 " " 938
20 " " 655

The following diagram represents this area and its subdivisions:



No. 1. 1896 to 1897.



No. 2. 1876 to 1897.

The figures in each division are the difference between the mean depths of the divisions for the years between which comparisons are made, and, therefore, represent the amount of shoaling or deepening in each.

No. 1 compares the mean depths in 1896 with those in 1897, and No. 2 compares those for 1876 with those for 1897. Shaded areas shoaled and all others deepened.

The mean change for the year over the whole area is a slight deepening, as given in the following table, which gives the amount of the mean change over the whole area since 1876:

Mean change over whole area.

From—	To—	Deepened.	Shoaled.	From—	To—	Deepened.	Shoaled.
		Feet.	*Feet.*			*Feet.*	*Feet.*
1876	1877		0.40	1887	1888		0.36
1877	1878	1.78		1888	1889	1.52	
1878	1879		2.24	1889	1890		1.09
1879	1880	0.02		1890	1891		2.25
1880	1881		2.18	1891	1892		1.64
1881	1882		1.31	1892	1893		2.05
1882	1883	0.25		1893	1894	1.06	
1883	1884		3.62	1894	1895	0.81	
1884	1885	1.17		1895	1896		2.63
1885	1886		0.14	1896	1897	0.07	
1886	1887		1.44	1876	1897		14.67

VELOCITY, SEDIMENT, AND TIDAL OBSERVATIONS.

Velocity, sediment, and tidal observations were continued during the year, but contained nothing of special interest more than is contained in previous reports, as follows: Report of the Chief of Engineers for 1896 and 1897, pages 1483 and 1747, respectively.

DEFICIENCIES IN DEPTH OF CHANNEL.

The deficiencies which occurred during the year in the depth of the channel at different localities throughout South Pass from the main river to the Gulf have been previously mentioned, but as there was a period when three localities were deficient at the same time a wrong impression may be gained as to the total days' deficiency. I give the following recapitulation.

The law requires that a channel having "a navigable depth of 26 feet" be maintained throughout South Pass and through the shoal at its head, and that the jetty channel at the mouth of the pass shall be "26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet, without regard to width."

From July 1 to 8, 1897, both dates inclusive, being eight days; from December 30, 1897, to January 25, 1898, both dates inclusive, being twenty-seven days; and from April 28 to May 17, both dates inclusive, being twenty days, the channel in Grand Bayou Reach was less than 26 feet in depth.

From April 23 to May 12, both dates inclusive, being twenty days, the channel in Goat Island Reach was less than 26 feet in depth.

From April 25 to 28, inclusive, being four days, the jetty channel was less than 30 feet in depth, and from May 28 to 30, inclusive, being three days, the channel in South Pass, near the foot of Goat Island, was less than 26 feet in depth.

It will be seen that on some of the days between April 23 and May 17 the channel at three different localities was deficient at the same time, and therefore the deficiency charged includes that period, together with the deficiency at any locality, after the others had been restored. In such cases—that is, when the deficiency occurs at different localities at the same time, which is unusual—I charge the deficiency to the locality which is the shoalest.

By this adjustment the deficiency throughout the entire channel for the year was as follows:

Date.		Locality.	Number of days deficient.
From—	To—		
1897.			
July	July 8	Grand Bayou Reach	8
Dec. 30	Jan. 25, 1898	do	27
1898.	1898.		
Apr. 23	May 12	Goat Island Reach	20
May 13	May 17	Grand Bayou Reach	5
May 28	May 30	Near foot of Goat Island	3
		Total	63

THE NAVIGATION OF THE CHANNEL.

During the year I reported the grounding of 20 steamers and 1 schooner, as follows: Schooner and 2 steamers in the Gulf beyond the end of the jetties, 10 steamers in Grand Bayou Reach, 4 in Goat Island Reach, 2 one-fourth of a mile below the Head of the Passes light-house, one 2 miles above South Pass light-house, and one between Grand Bayou and Goat Island.

Three steamers drew 26 feet, 5 drew 25 feet or more, 6 drew 24 feet or more, and the draft of the others varied from 14 to 22½ feet.

Sixteen steamers were aground from one to twenty-five hours, 1 fifty hours, 1 thirty-six hours, 1 seven days, and 1 four days. The schooner, which was the *H. C. Winship*, was anchored off the jetties on the night of September 4, 1897. During a severe gale her anchor chains parted, and she was driven aground 2,340 feet south and 1,400 feet west of the east light and was wrecked.

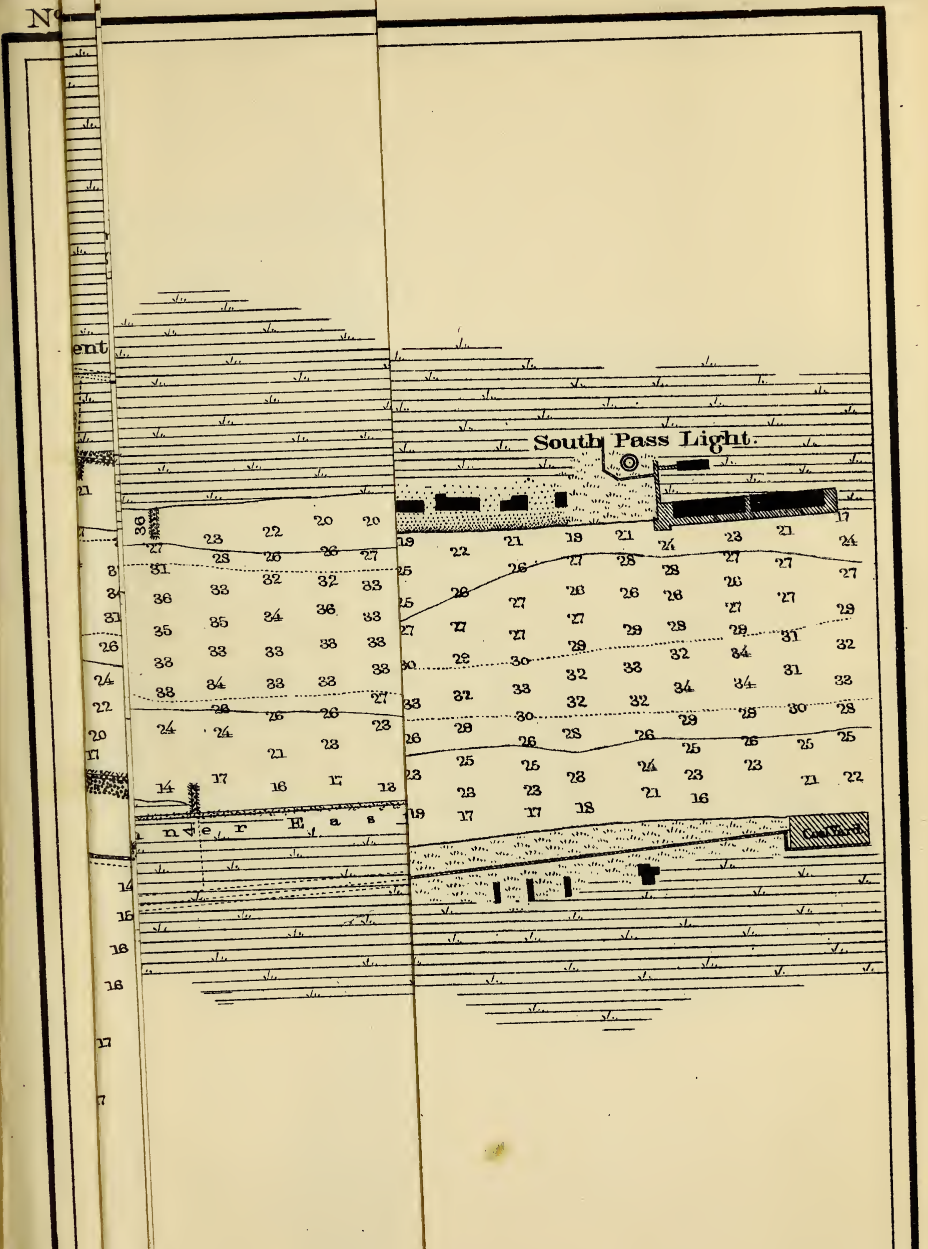
CONCLUSION.

During the year Mr. G. W. Lawes, assistant engineer, rendered efficient assistance.

Very respectfully, your obedient servant,

C. DONOVAN, *Assistant Engineer.*

Maj. JAMES B. QUINN,
Corps of Engineers, U. S. A.



report for the year ending June 30, 1898.

James B. Quinn

Major, Corps of Eng'rs, U. S. A.

No 1

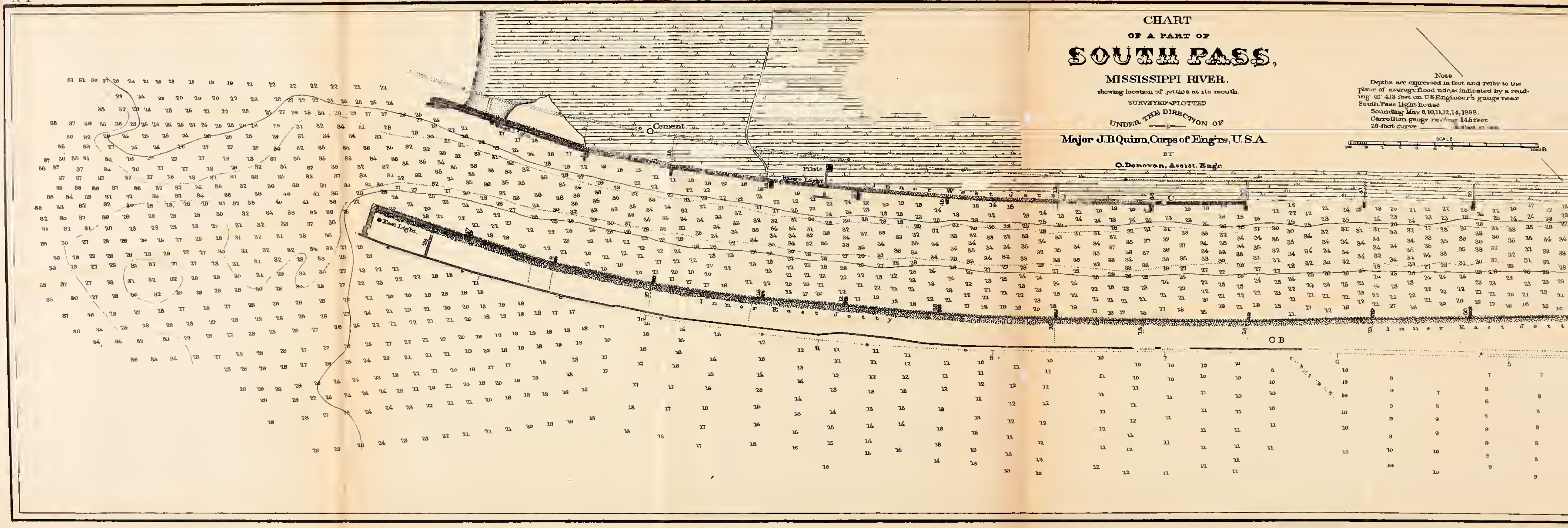


CHART
OF A PART OF
SOUTH PASS,
MISSISSIPPI RIVER.

showing location of jetties at its mouth.

SURVEYED & PLOTTED

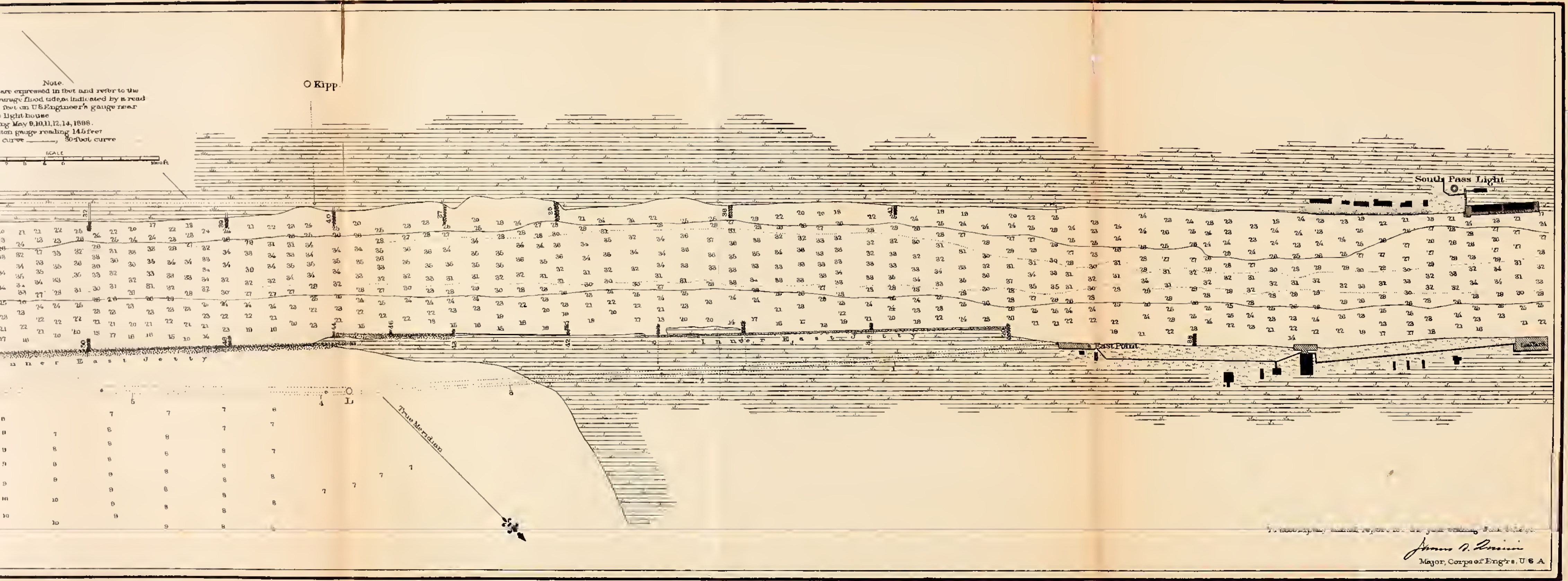
UNDER THE DIRECTION OF

Major J. B. Quinn, Corps of Eng'rs, U.S.A.

BY

O. Donovan, Assist. Engr.

Note.
Depths are expressed in feet and refer to the plane of average flood tide, as indicated by a reading of 4.13 feet on U.S. Engineer's gauge near South Pass light house
Sounding May 9, 10, 11, 12, 14, 1888.
Carrollton gauge reading 14.5 feet
28-foot curve [illegible]



Note.
are expressed in feet and refer to the
average flood tide, as indicated by a read
feet on U.S. Engineer's gauge near
light house
ng May 9,10,11,12,14, 1898.
ton gauge reading 14.5 feet
curve ————, 30-foot curve

To accompany annual report for the year ending June [illegible]

James B. Quinn
Major, Corps of Eng'rs, U S A

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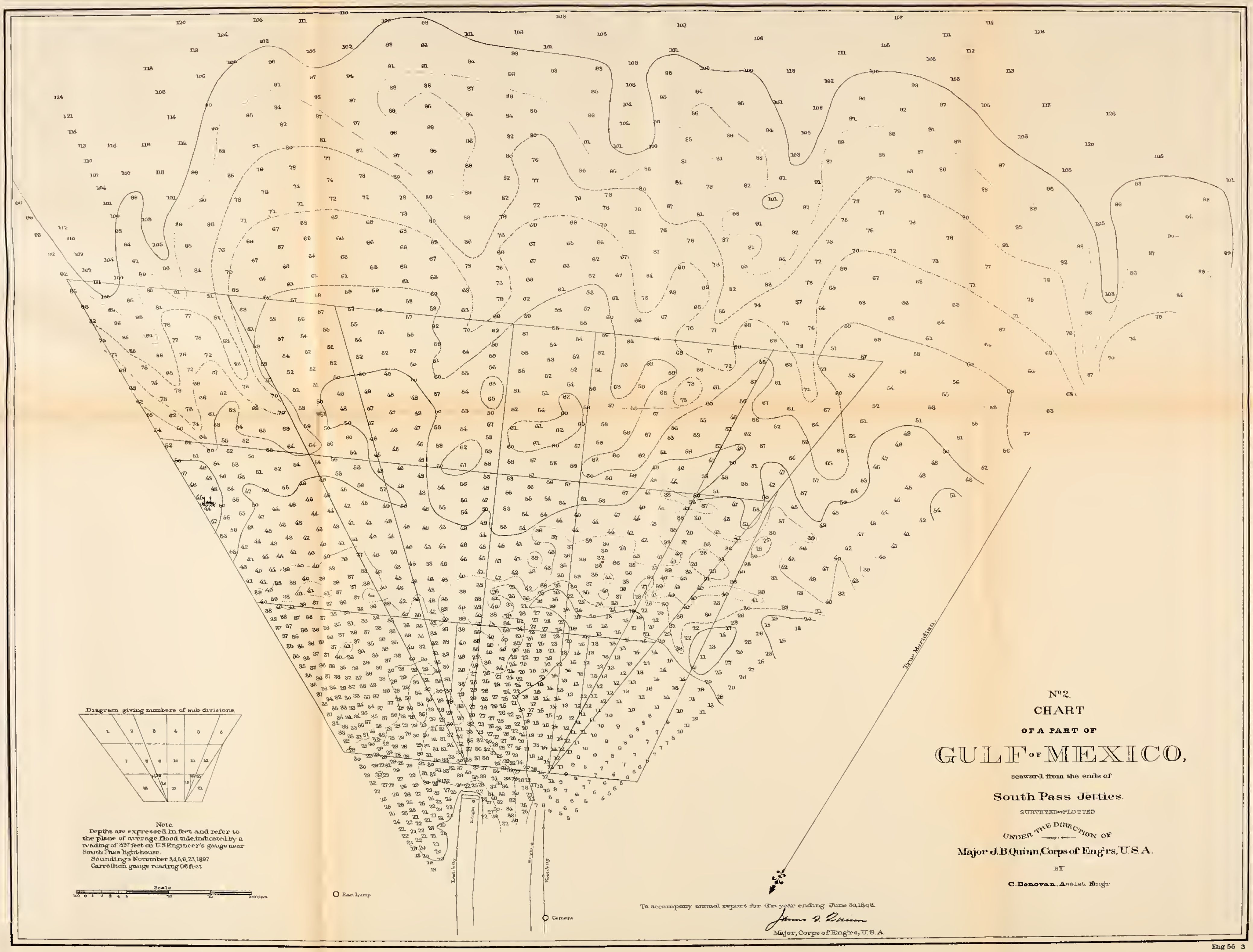
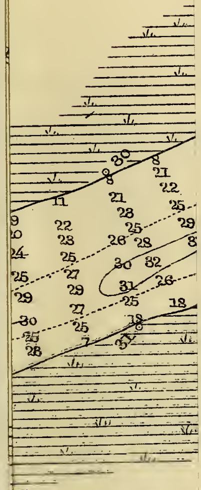


Nº 2.
CHART
OF A PART OF
GULF OF MEXICO,
seaward from the ends of
South Pass Jetties.
SURVEYED AND PLOTTED
UNDER THE DIRECTION OF
Major J. B. Quinn, Corps of Eng'rs, U.S.A.
BY
C. Donovan, Assist. Engr

Note.
Depths are expressed in feet and refer to the plane of average flood tide, indicated by a reading of 3.97 feet on U.S. Engineer's gauge near South Pass light-house.
Soundings November 3,4,5,9,23,1897
Carrollton gauge reading 0.6 feet

To accompany annual report for the year ending June 30,1898.

James B. Quinn
Major, Corps of Eng'rs, U.S.A.


8
8
21
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11
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31
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25
18
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7
28

No3.

CHART

OF A PART OF

SOUTH PASS,

MISSISSIPPI RIVER.

SURVEYED—PLOTTED

UNDER THE DIRECTION OF

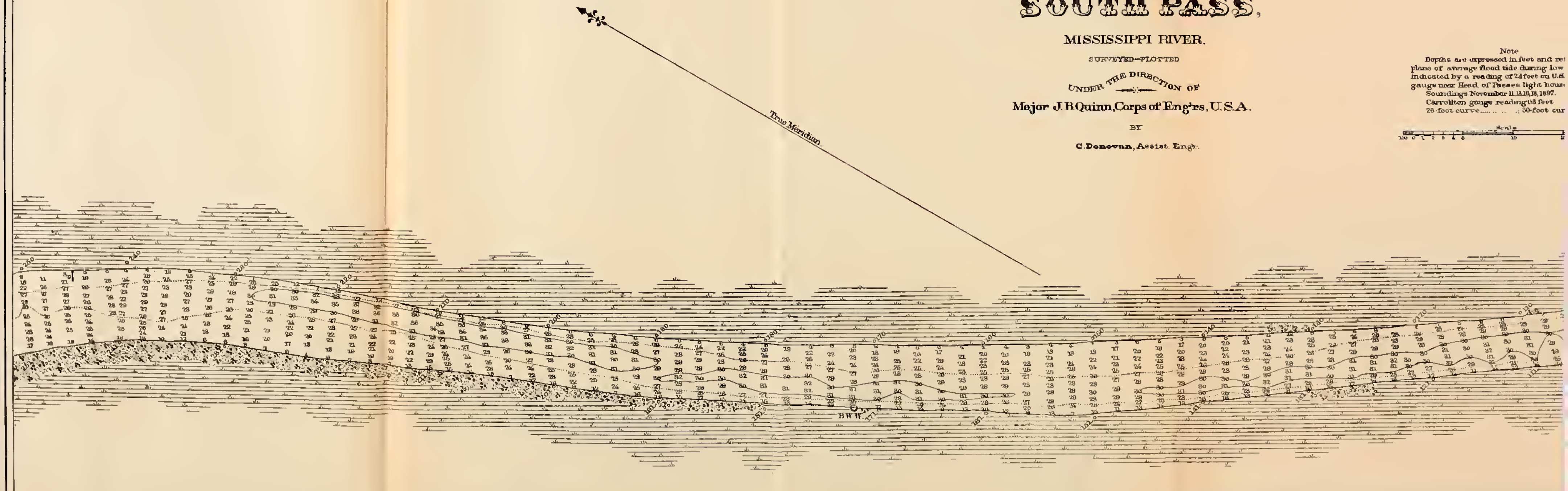
Major J. B. Quinn, Corps of Eng'rs, U.S.A.

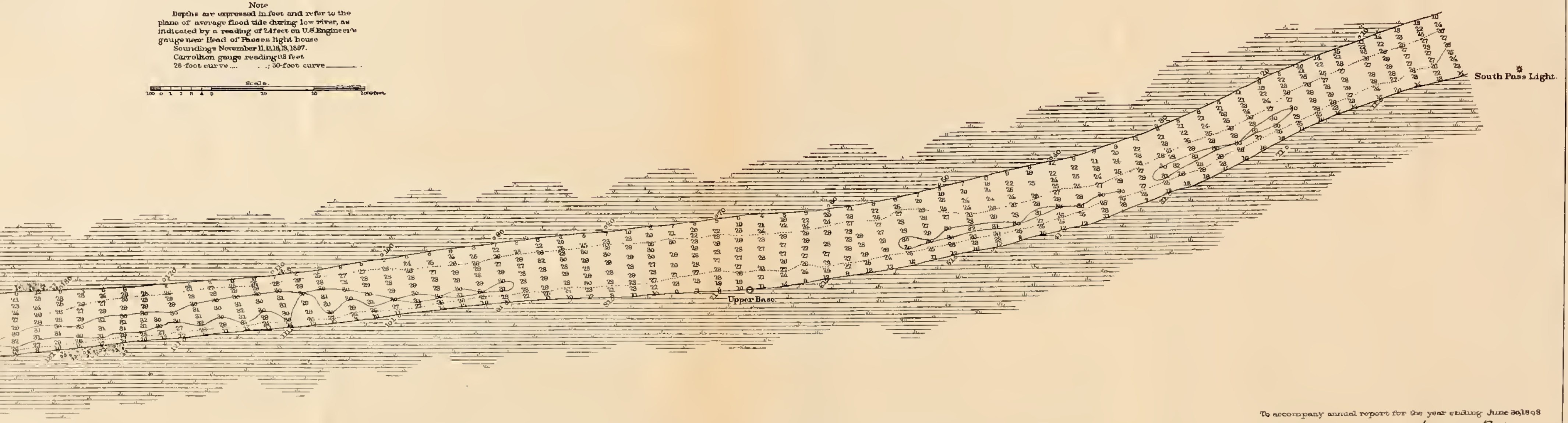
BY

C. Donovan, Assist. Eng'r.

Note

Depths are expressed in feet and re
plane of average flood tide during low
indicated by a reading of 24 feet on U.S
gauge near Head of Passes light hous
Soundings November 11, 12, 16, 18, 1897.
Carrollton gauge reading 1.8 feet
28-foot curve........ ; 30-foot cur





Note

Depths are expressed in feet and refer to the plane of average flood tide during low river, as indicated by a reading of 2.4 feet on U.S. Engineer's gauge near Head of Passes light house

Soundings November 11, 12, 16, 18, 1897.

Carrolton gauge reading 1.8 feet

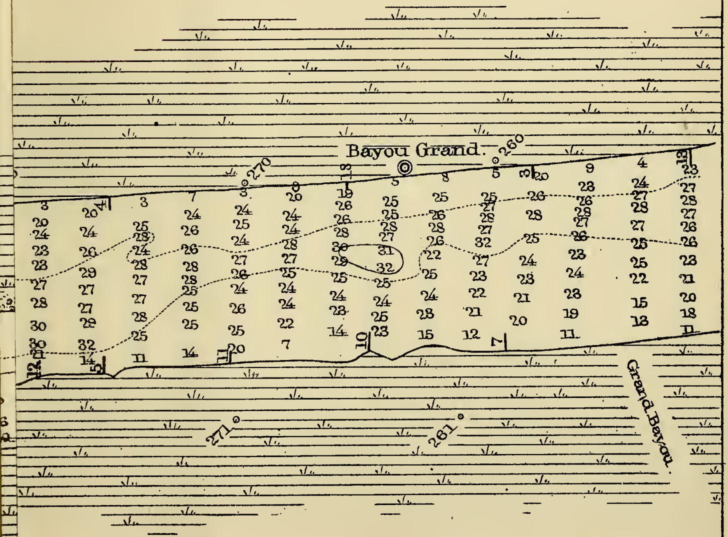
26-foot curve .... . .; 30-foot curve ———— .

To accompany annual report for the year ending June 30, 1898

James B. Quinn

Major, Corps of Eng'rs, U.S.A.

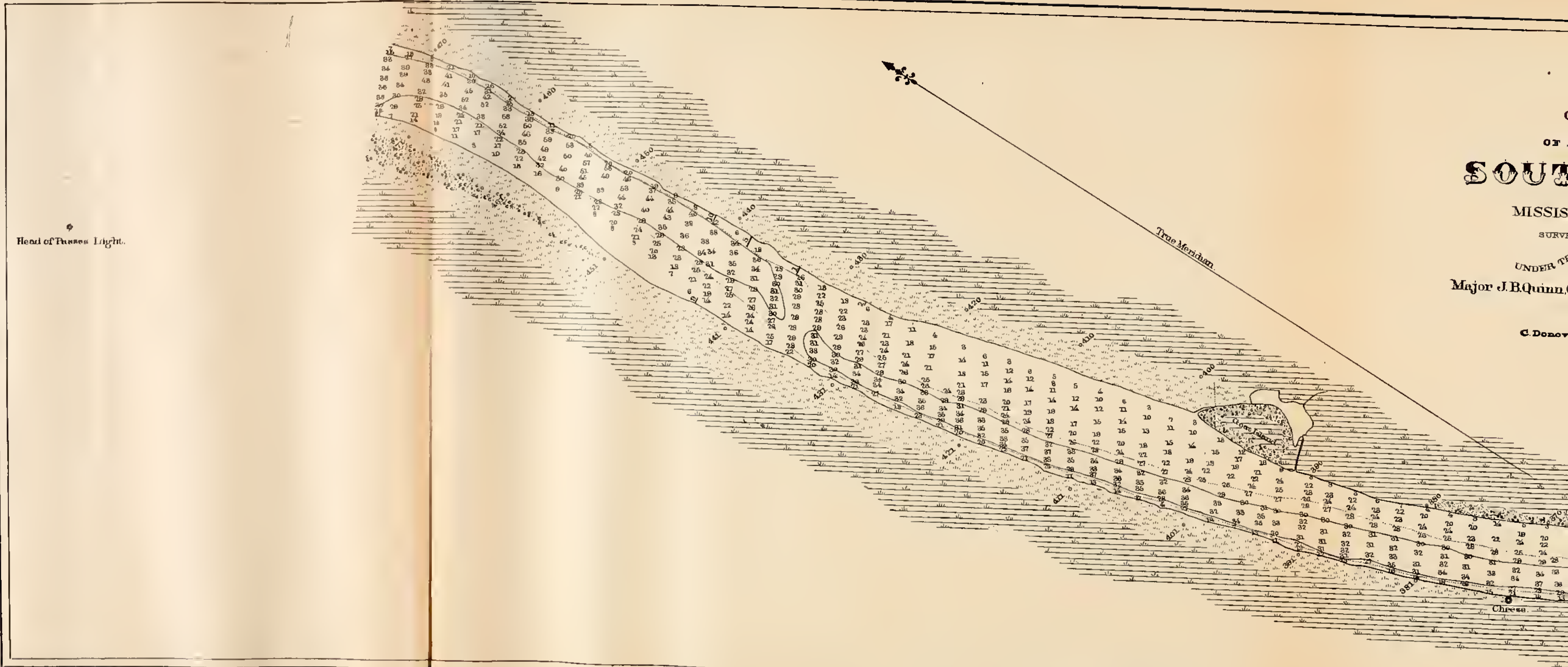
Eng 55 3



To accompany annual report for the year ending June 30,1898.

James B. Quinn

Major, Corps of Eng'rs, U.S.A.

C
OF
SOUT
MISSIS
SURV
UNDER T
Major J.B.Quinn,
C.Donov
Head of Passes Light
True Meridian
Goose Island
Cheese

N°4
CHART
OF A PART OF

SOUTH PASS,

MISSISSIPPI RIVER.
SURVEYED—PLOTTED
UNDER THE DIRECTION OF
Major J. B. Quinn, Corps of Eng'rs, U.S.A.
BY
C. Donovan, Assist. Engr.

Note

Depths are expressed in feet and refer to the plane of average flood tide during low river, as indicated by a reading of 24 feet on U.S. Engineer's gauge near Head of Passes light house.

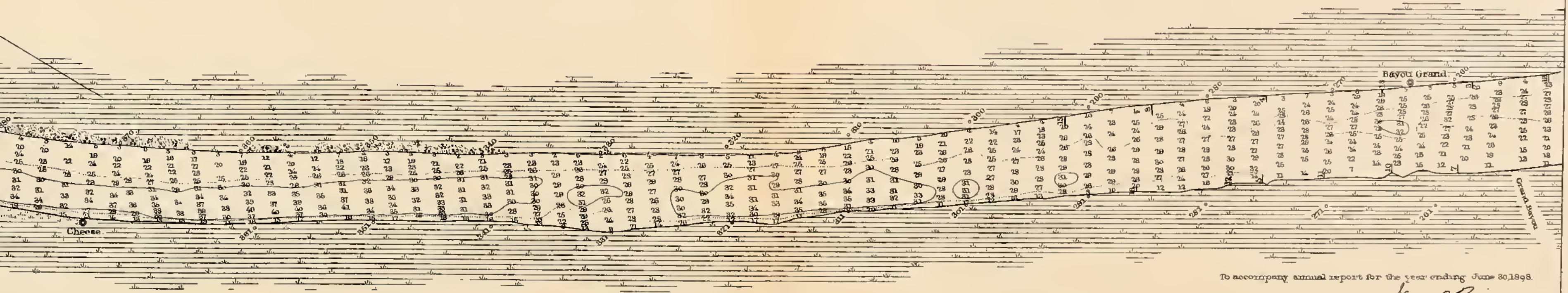
Soundings November 11, 13, 16, 18 1897

Carrollton gauge reading 0.8 feet.

28-foot curve . . . . 30-foot curve ———

Scale

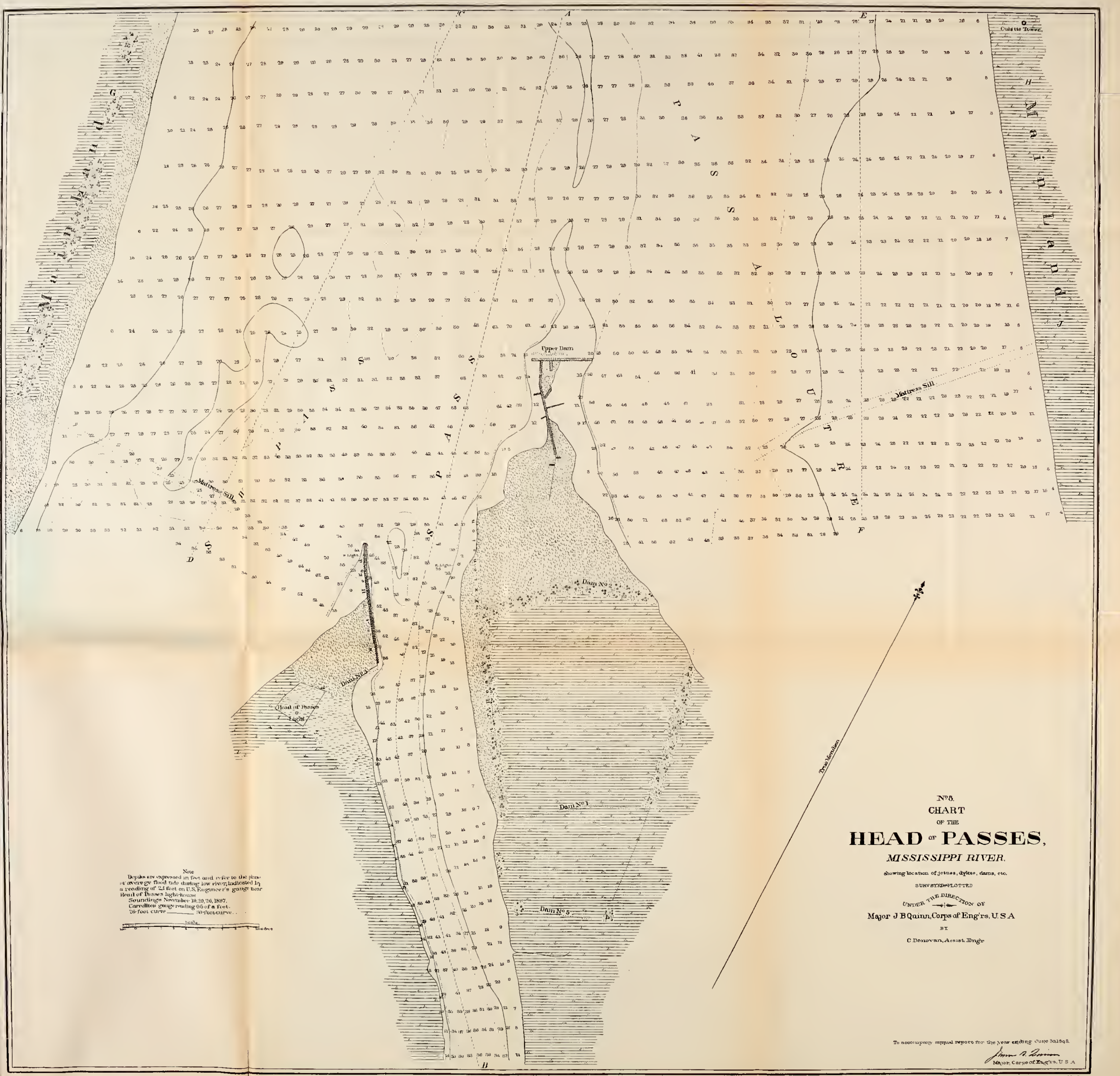
100 0 1 2 3 4 5 10 15 2000 feet



To accompany annual report for the year ending June 30, 1898.

James B. Quinn
Major, Corps of Eng'rs, U.S.A.

Major, Corps of Eng'rs, U.S.A.



N° 5.
CHART
OF THE

HEAD OF PASSES,

MISSISSIPPI RIVER.

showing location of jetties, dykes, dams, etc.

SURVEYED & PLOTTED

UNDER THE DIRECTION OF

Major J B Quinn, Corps of Eng'rs, U S A

BY

C Donovan, Assist. Eng'r

Note

Depths are expressed in feet and refer to the plane of average flood tide during low river, indicated by a reading of 2.4 feet on U.S. Engineer's gauge near Head of Passes light-house.

Soundings November 19, 20, 26, 1897.

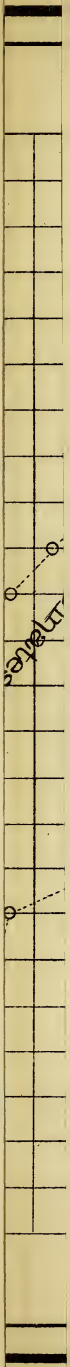
Carrollton gauge reading 0.6 of a foot.

26-foot curve ———— 30-foot curve . . . .

To accompany annual report for the year ending June 30 1898.

Jam B. Quinn
Major, Corps of Eng'rs. U S A

Eng 55 3



Comparative Diagrams

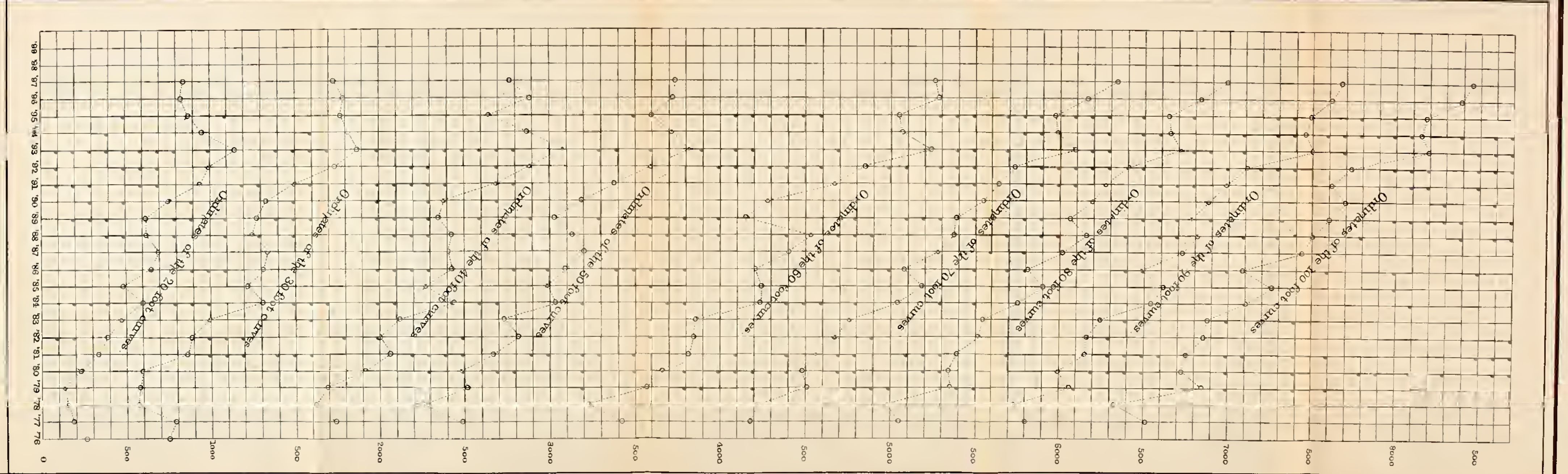
showing by mean ordinates the distances of the

Curves of various Depths
seaward from the ends of
South Pass Jetties,
for each year from 1876 to 1897.

COMPILED BY
C. Donovan, Assist. Eng'r.

Rectangular ordinates 100 feet apart were measured from a base passing through the present ends of the jetties.

The mean of all the ordinates for each curve gives the distance of the same from the end of the jetties.



APPENDIX U.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS.

REPORT OF MAJ. JAMES B. QUINN, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Chefuncte River and Bogue Falia, Louisiana.
2. Tickfaw River and its tributaries, Louisiana.
3. Amite River and Bayou Manchac, Louisiana.
4. Bayou Lafourche, Louisiana.
5. Bayou Plaquemine, Grand River, and Pigeon Bayous, Louisiana.
6. Bayou Courtableau, Louisiana.
7. Bayou Teche, Louisiana.
8. Channel, bay, and passes of Bayou Vermilion, Louisiana.
9. Mermentau River and tributaries, Louisiana.
10. Mouth and passes of Calcasieu River, Louisiana.
11. Harbor at Sabine Pass, Texas.
12. Sabine River, Texas.
13. Closing crevasse in Pass a Loutre, Mississippi River.
14. Removing sunken vessels or craft obstructing or endangering navigation.

SURVEY.

15. Homochitto River, Mississippi.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., July 18, 1898.

GENERAL: I have the honor to transmit herewith annual reports upon works of river and harbor improvement at present under my charge * * * for the fiscal year ending June 30, 1898, as follows.

* * * * * * *

Very respectfully, your obedient servant,

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

U 1.

IMPROVEMENT OF CHEFUNCTE (TCHEFUNCTE) RIVER AND BOGUE FALIA, LOUISIANA.

No work was done on this stream during the year just closed. For the history of this work and details of improvement, see Appendix R, page 1485, Annual Report of Chief of Engineers for 1896.

The total expended on this work to June 30, 1898, amounted to $8,393.79.

Money statement.

July 1, 1897, balance unexpended	$1,150.71
June 30, 1898, amount expended during fiscal year	44.50
July 1, 1898, balance unexpended	1,106.21
July 1, 1898, outstanding liabilities	10.00
July 1, 1898, balance available	1,096.21
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	*1,000.00

Abstract of appropriations for improving Chefuncte (Tchefuncte) River and Bogue Falia, Louisiana.

By act of Congress—	
Approved March 3, 1881	$1,500
Passed August 2, 1882	1,500
Approved August 5, 1886	2,500
Approved September 19, 1890	1,000
Approved July 13, 1892	1,000
Of August 18, 1894	1,000
Passed June 3, 1896	1,000
Total	9,500

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		11
Trips		707
Net registered tonnage (707 trips)	tons	89,231
Schooners		44
Trips		412
Net registered tonnage (412 trips)	tons	14,038
Barges		12
Trips		159
Net tonnage (159 trips)	tons	11,707
Total vessels		67
Total trips		1,278
Total tonnage	tons	114,976

Draft of heaviest vessel, light, 5.2 feet; loaded, 7 feet.

---

* The estimate submitted is for maintenance, $1,000 being required annually.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Lumber, shingles, laths	61,548	$220,993	47,911	$141,258
Bricks	12,370	27,214	15,280	33,316
Sand	27,089	16,332	23,081	23,081
Wood	61	1,360	978	1,956
Cotton	361	49,225	502	56,252
Rice	160	3,299	52	2,393
Miscellaneous	26	1,325	63	485
Sheep, cattle, horses	453	13,975	114	9,938
Tar, rosin, turpentine	823	13,398	1,897	71,468
Sirup	61	2,120	104	1,806
Wool	2	453	3	1,080
Total	102,954	349,694	89,985	343,033
RECEIPTS.				
Merchandise	7,080	283,200	9,520	380,800
Grand total	110,034	632,894	99,505	723,833

Comparative statement of receipts and shipments for eight years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1891	45,521	$201,061	1895	49,778	$350,111
1892	50,054	354,684	1896	67,680	621,454
1893	30,284	429,126	1897	110,034	632,894
1894	242,464	919,699	1898	99,505	723,833

U 2.

IMPROVEMENT OF TICKFAW RIVER AND ITS TRIBUTARIES, LOUISIANA.

The primary project for the improvement of the Tickfaw River and its tributaries (the Natalbany, Blood, and Ponchatoula rivers) was adopted in 1881, and provided for placing the streams in a navigable condition as far as possible by removal of obstructions. The estimated cost was $10,230.

Under this project, and with appropriations aggregating $10,000, about 30 miles of the Tickfaw River and its branches were improved, extending to the heads of navigation.

For detailed information as to the history of this work and its progress see Annual Report of the Chief of Engineers for 1896, pages 1488, 1489.

On June 3, 1896, an appropriation of $1,000 was made for maintenance of this improvement. With the funds on hand it was attempted to remove the water hyacinths, which had clogged the streams, but after working near the mouth of the river from February 26, 1897, to March 31, 1897, it was found the plants floated in almost as fast as they were removed. For details of this attempt see Appendix S, pages 1753, 1754, Annual Report of the Chief of Engineers for 1897.

The amount expended on the improvement to June 30, 1898, was $10,857.51.

No work was done on these streams during the fiscal year just ended.

Money statement.

July 1, 1897, balance unexpended	$146.94
June 30, 1898, amount expended during fiscal year	4.45
July 1, 1898, balance unexpended	142.49
July 1, 1898, outstanding liabilities	10.00
July 1, 1898, balance available	132.49
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	*1,000.00

Abstract of appropriations for improving Tickfaw River and tributaries, Louisiana.

By act of Congress—

Approved March 3, 1881	$2,000
Passed August 2, 1882	2,000
Approved August 5, 1886	2,000
Of August 11, 1888	1,000
Approved September 19, 1890	1,000
Approved July 13, 1892	1,000
Passed August 18, 1894	1,000
Passed June 3, 1896	1,000
Total	11,000

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers	6
Trips	254
Net registered tonnage (254 trips) ... tons	13,938
Schooners	21
Trips	269
Net registered tonnage (269 trips) ... tons	5,905
Total vessels	27
Total trips	523
Total tonnage (523 trips) ... tons	19,843

Draft of heaviest vessel, light, 5 feet; loaded, 6.6 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Wood	2,988	$7,470	3,855	$8,989
Lumber	49,880	166,180	66,282	203,162
Brick	1,250	2,750	150	333
Cotton	121	16,310	158	17,696
Miscellaneous	38	2,140	28	1,968
Total	54,277	194,850	70,473	232,148
RECEIPTS.				
Merchandise	3,838	141,520	5,106	204,240
Grand total	58,115	336,370	75,579	436,388

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*The estimate submitted is for maintenance, $1,000 being required annually.

Comparative statement of receipts and shipments for six years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	13,994	$169,643	1896	72,851	$353,246
1894	40,003	251,774	1897	58,115	336,370
1895	23,384	220,566	1898	75,579	436,388

Increase in 1898 over 1897, 17,464 tons.

U 3.

IMPROVEMENT OF AMITE RIVER AND BAYOU MANCHAC, LOUISIANA.

The original project for this improvement was adopted in 1880 and modified in 1883. With the various appropriations made, amounting to $28,800, the river and bayou were improved by snagging and dredging from the mouth of Wards Creek to the mouth of Amite River, and a turning basin for boats made at the mouth of Wards Creek, on Bayou Manchac. The work was continued to May 31, 1895.

No work was done on these streams during the year just closed.

There was expended during the fiscal year ending June 30, 1898, the sum of $93.66.

The history and detailed progress of the work done will be found on pages 1490 and 1491, Appendix R, Annual Report of the Chief of Engineers for 1896.

Money statement.

July 1, 1897, balance unexpended	$2,809.70
June 30, 1898, amount expended during fiscal year	93.66
July 1, 1898, balance unexpended	2,716.04
July 1, 1898, outstanding liabilities	10.00
July 1, 1898, balance available	2,706.04
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	*2,500.00

Abstract of appropriations for improving Amite River and Bayou Manchac, Louisiana.

By act of Congress—

Approved June 14, 1880	$8,000
Approved March 3, 1881	5,000
Approved August 5, 1886	2,000
Of August 11, 1888	5,000
Approved September 19, 1890	3,800
Approved July 13, 1892	2,500
Of August 18, 1894	2,500
Passed June 3, 1896	2,500
Total	31,300

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* The estimate submitted is for maintenance, $2,500 being required annually.

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		8
Trips		486
Net registered tonnage (486 trips)	tons..	21, 346
Schooners		35
Trips		175
Net registered tonnage (175 trips)	tons..	4, 095
Total vessels		43
Total trips		661
Total tonnage (661 trips)	tons..	25, 441

Draft of heaviest vessel, light, 6 feet; loaded, 7 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31— 1897. Tons.	1897. Value.	1898. Tons.	1898. Value.
SHIPMENTS.				
Lumber, shingles, laths	34, 474	$107, 977	35, 060	$125, 299
Wood	4, 898	11, 754	10, 456	19, 418
Staves	1, 035	30, 862	1, 260	6, 156
Sugar and molasses	90	3, 146	17	660
Cotton and cotton seed	1, 630	137, 602	1, 996	134, 064
Miscellaneous	80	6, 042	153	8, 600
Total	42, 207	297, 383	48, 942	294, 197
RECEIPTS.				
Merchandise	7, 302	219, 060	5, 807	222, 280
Grand total	49, 509	516, 443	54, 749	516, 477

Comparative statement of receipts and shipments for eight years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1891	17, 792	$300, 963	1895	42, 983	$491, 216
1892	18, 530	334, 061	1896	55, 103	414, 245
1893	22, 099	346, 257	1897	49, 509	516, 443
1894	157, 902	796, 305	1898	54, 749	516, 477

Increase of 1898 over 1897, 5,240 tons.

U 4.

IMPROVEMENT OF BAYOU LAFOURCHE, LOUISIANA.

The original project for this improvement was adopted in 1879, and with the various appropriations, amounting to $30,000, the work was carried on to 1888. Since that time the improvement has been carried on under the project of June 11, 1886, and the modification of same approved September 23, 1896.

Under these projects over 70 miles of channel have been improved by dredging and removal of obstructions, resulting in much benefit to the navigation of the stream.

For details of the progress of the work, see Appendix R, pages 1493 and 1494, Annual Report of the Chief of Engineers for 1896.

Contract for dredging, entered into with Mr. Henry Camors, of New Orleans, La., was approved June 16, 1896, and on August 3, 1896, the contract was approved for working double time for three months from

September 1, 1896. Operations were continued to February 13, 1897, and greatly benefited the commerce of the bayou. (See Appendix S, pages 1757, 1758, Annual Report of Chief of Engineers for 1897.)

Owing to an emergency, arrangements were made with Capt. G. McC. Derby, Corps of Engineers, for the use of the Government dredge *Ram*, to remove the bar at the head of the bayou, but after working about fifteen days in August, 1897, the dredge was withdrawn for work elsewhere, before completing the cut.

On December 8, 1897, contract was entered into with Mr. Frank Beck, of New Orleans, La., for the hire of a dredge boat for the continuation of the improvement. Work was commenced September 13, 1897, and ended February 1, 1898, resulting in the removal of 106,023 cubic yards of material and 70 obstructions, such as snags and logs.

Under advertisement, proposals for dredging in the bayou to continue the improvement were opened on June 24, 1898. Authority was received on June 28, 1898, to accept the bid of Frank Beck, of New Orleans, La., he being the lowest bidder. This contract calls for the hire of a dredge and crew at the rates of $64.50 per day of eight hours, and the same for eight hours additional per day. Contract was entered into June 29, 1898, and forwarded to the Chief of Engineers for approval. It is contemplated under this contract to dredge through the bars to preserve flatboat navigation during the low-water season on the bayou, the dredged channel, when completed, to have a depth of 3 feet below mean low water, and a width of about 60 feet. The contract is to be in force until the stage of water in the bayou will permit the entrance of steamboats.

So long as the improvement is confined to dredging to maintain flatboat navigation an annual appropriation of $25,000 is necessary.

The amount expended on this improvement during the fiscal year ended June 30, 1898, is $17,232.40.

Money statement.

July 1, 1897, balance unexpended		$60,012.10
June 30, 1898, amount expended during fiscal year		17,232.40
July 1, 1898, balance unexpended		42,779.70
July 1, 1898, outstanding liabilities	$77.00	
July 1, 1898, amount covered by uncompleted contracts	12,000.00	
		12,077.00
July 1, 1898, balance available		30,702.70
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		*25,000.00

Abstract of appropriations for improving Bayou Lafourche, Louisiana.

By act of Congress—	
Approved June 18, 1878	$10,000
Approved March 3, 1879	10,000
Approved June 14, 1880	5,000
Approved July 5, 1884	5,000
Of August 11, 1888	50,000
Approved September 19, 1890	50,000
Approved July 13, 1892	50,000
Of August 18, 1894	40,000
Passed June 3, 1896	25,000
Total	245,000

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* The estimate submitted is for maintenance, $25,000 being required annually.

Abstract of proposals for hire of dredge for improving Bayou Lafourche, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, September 3, 1897.

No.	Name and address of bidder.	Amount of bid.	
		Per day of 8 hours.	8 additional hours per day.
1	Henry Camors, New Orleans, La	$77.00	$77.00
2	Frank Beck, New Orleans, La	64.50	64.50

Contract awarded to Frank Beck, the lowest bidder. Approved September 15, 1897. Work was commenced on September 13, 1897, under telegraphic authority, and completed on February 1, 1898.

Abstract of proposals for hire of dredge for improving Bayou Lafourche, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, June 24, 1898.

No.	Name and address of bidder.	Amount of bid.	
		Per day of 8 hours.	8 additional hours per day.
1	Henry Camors, New Orleans, La	$68.30	$67.00
2	Frank Beck, New Orleans, La	64.50	64.50

Contract awarded to Frank Beck by telegraphic authority from the Chief of Engineers, June 28, 1898.

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		33
Trips		780
Net registered tonnage (780 trips)	tons..	135,668
Luggers		62
Trips		62
Net registered tonnage (62 trips)	tons..	558
Barges		164
Trips		164
Gross tonnage (164 trips)	tons..	123,370
Total vessels		259
Total trips		1,006
Total tonnage (1,006 trips)	tons..	259,596

Draft of heaviest vessel, light, 3 feet; loaded, 9 feet.

NOTE.—Not included in the above tonnage are flatboats regularly employed in the bayou carrying freights to and from the railroads at three different transfers, or connecting with steamboats during low water at the head of the bayou in the Mississippi River.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Sugar	45,729	$2,551,972	67,553	$4,368,785
Molasses	28,253	256,848	25,438	590,640
Rice	2,243	62,312	2,646	107,274
Potatoes and onions	5,260	164,377	6,646	154,800
Eggs	175	17,529	131	15,747
Moss	303	12,780	359	14,368
Pecans	8	1,224	13	1,990
Miscellaneous	199	13,034	474	12,168
Total	82,170	3,080,076	103,260	5,265,772
RECEIPTS.				
Miscellaneous	54,302	1,625,929	51,883	1,721,161
Coal	80,820	282,870	114,255	380,850
Grand total	217,292	4,988,875	269,398	7,367,783

Comparative statement of receipts and shipments for eight years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1891	217, 273	$8, 244, 225	1895	263, 607	$9, 224, 554
1892	171, 885	5, 660, 662	1896	229, 891	5, 629, 237
1893	212, 476	7, 422, 285	1897	217, 292	4, 988, 875
1894	273, 686	8, 842, 942	1898	269, 398	7, 367, 783

Increase of 1898 over 1897, 52,106 tons, representing a value of $2,378,908.

U 5.

IMPROVEMENT OF BAYOU PLAQUEMINE, GRAND RIVER, AND PIGEON BAYOUS, LOUISIANA.

For convenience of reference, the operations under this improvement are divided into subheadings.

For a history of the improvement and details of the work done under it in its various branches up to and including June 30, 1896, see Appendix R, pages 1496 to 1500, Annual Report of the Chief of Engineers for 1896.

GRAND RIVER AND PIGEON BAYOUS.

In the appropriation of June 3, 1896, it is provided that $10,000 may be used in the improvement of Grand River and Pigeon bayous, a part of the Plaquemine all-water route.

On January 22, 1897, contract was entered into with Mr. Harrison P. Dilworth, of New Orleans, La., for the hire of a dredge, which was approved February 1, 1897. Operations were commenced on March 26, 1897, and finished August 20, 1897, resulting in the removal of 67,085 cubic yards of material, 2,126 stumps, 130 logs, and many overhanging trees.

BANK-PROTECTION WORK.

During the past year three caves occurred in the bank of the Mississippi River, near the end of the pit, but none of them being serious, it was believed that no repairs would be necessary. The banks have since assumed a regular slope.

PLAQUEMINE LOCK.

Under this part of the improvement, work was continued during the past fiscal year under contract entered into with Mr. E. A. Burriss, of New Orleans, La., under date of June 24, 1895.

For details of the progress of the work up to and including June 30, 1897, see Appendix S, page 1760, Annual Report of the Chief of Engineers for 1897.

A supplemental contract was made with Mr. Burriss for the removal of 60,000 cubic yards of material, made necessary by caving banks. This supplemental contract was at regular contract prices, and was approved February 27, 1897.

Another supplemental contract was approved by the Chief of Engineers June 19, 1897, for driving 800 piles of 60 feet lengths instead of the same number of 50 feet lengths. Owing to the alluvial soil, it was believed that the longer piles would be required to obviate any further disarrangement of the sheet piling, and at the same time the weight of the masonry to be borne by them would be reduced and the cost of the work cut down.

In December, 1897, a portion of the sheet piling surmounting the foundation of the lock was driven in in a very peculiar manner. The sheet piling proved to be too light to withstand the peculiar movement of the soil outside the inclosure it forms. The natural slope of the banks of the bayou at the place where the work was being done proved to be misleading when the calculations were made, the material standing fairly well for a time and then suddenly collapsing. The piling is not broken off, but is overturned as if nothing offered any resistance. It is not believed that any attempts at maintaining it in position will be successful. The foundation piles were not disturbed in any way. As the contractor had completed the work in accordance with specifications, it was not considered that he was responsible for the overturning of the sheet piling, and estimates for removing the additional earth were incorporated in the specifications for completing the lock.

Four extensions were granted the contractor on the original and supplemental contracts, one from July 20, 1896, to January 31, 1897; one from January 31, 1897, to June 30, 1897; one from June 30, 1897, to October 1, 1897, and one from October 1, 1897, to December 31, 1897. By this last date all the work called for under these contracts had been completed.

Owing to the extraordinarily high water of 1897, a complete revision of the lock plans became necessary. Plans and specifications were completed and forwarded to the Chief of Engineers on November 22, 1897. Proposals for completing the lock having been invited, the award was made to Stewart & Co., of St. Louis, Mo., for the sum of $501,757.60. Contract was entered into on May 28, 1898, and approved June 17, 1898, and arrangements are now being made by the contractors to commence work at an early date. This contract was made under the provisions of the continuing-contract system contained in the act of June 3, 1896.

The amount expended on this improvement up to June 30, 1898, was $452,255.12, or $56,229.72 during the fiscal year just passed.

The following is an estimate of this work carried on under the provisions of the continuing-contract system as outlined above:

Amount of continuous contract authorized in act of June 3, 1896		$1,173,250.00
Amount appropriated by sundry civil act approved June 4, 1897		350,000.00
Balance unappropriated		823,250.00
Contract with Stewart & Co., St. Louis, Mo., approved June 17, 1898		501,757.60
Amount required for fiscal year ending June 30, 1900		400,000.00
Based on the following estimates:		
Concrete, 20,500 cubic yards, at $3.37	$69,085.00	
Medium steel, 1,699,810.25 pounds, at $0.039	66,292.60	
High forged steel, 15,000 pounds, at $0.09⅕	1,380.00	
High cast steel, 200,000 pounds, at $0.07½	15,000.00	
Power house, operating machinery, etc	100,000.00	
Dredge	60,000.00	
Rectification of bayou	88,242.40	
		400,000.00

Money statement.

July 1, 1897, balance unexpended		$433, 974. 60
June 30, 1898, amount expended during fiscal year		56, 229. 72
July 1, 1898, balance unexpended		377, 744. 88
July 1, 1898, outstanding liabilities	$409. 00	
July 1, 1898, amount covered by uncompleted contracts for fiscal year 1899	* 350, 000. 00	
		350, 409. 00
July 1, 1898, balance available		27, 335. 88
Amount (estimated) required for completion of existing project		878, 250. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900		400, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations for improving Bayou Plaquemine, Louisiana.

By act of Congress—	
Of August 11, 1888	$100, 000
Approved September 19, 1890	100, 000
Approved July 13, 1892	150, 000
Of August 18, 1894	110, 000
Of June 3, 1896	20, 000
Sundry civil act approved June 4, 1897	350, 000
Total	830, 000

Abstract of proposals for constructing lock and approaches for improving Bayou Plaquemine, Louisiana, opened April 15, 1898, by Maj. James B. Quinn, Corps of Engineers.

No.	Name and address of bidder.	Amount of bid.
1	Christie, Lowe & Hayworth, Chicago, Ill	$680, 863. 94
2	Griffiths & McDermott, Chicago, Ill	616, 674. 36
3	J. V. Haag, jr., Pittsburg, Pa	1, 005, 582. 77
4	American Constructing Co. (Ira E. Wight), New Orleans, La	694, 323. 20
5	Jacob Friday Co., Pittsburg, Pa	595, 938. 70
6	Stewart & Co., St. Louis, Mo	501, 757. 60
7	Western Construction Co. and McArthur Bros. Co., Charleston, W. Va., and Chicago, Ill	675, 854. 52
8	The National Constructing Co., New York	602, 644. 56
9	Chicago Star Construction and Dredging Co., Chicago, Ill	635, 498. 98
10	Warren-Scharff Asphalt and Paving Co., New York, N. Y	636, 615. 52
11	Lyden & Burke, Chicago, Ill	567, 653. 36

Contract awarded to Stewart & Co., the lowest bidders. Contract approved June 17, 1898. Work not yet commenced.

CONTRACT NOW IN FORCE FOR IMPROVING BAYOU PLAQUEMINE, LOUISIANA.

For constructing lock and approaches for improving Bayou Plaquemine, Louisiana: Contract awarded to Stewart & Co., St. Louis, Mo., for $501,757.60; approved June 17, 1898. Work not yet commenced. Contract made under the provisions of continuing contract system contained in act of June 3, 1896.

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* The approved continuous contract calls for the expenditure of $501,757.60.

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers	5
Trips	52
Net registered tonnage (52 trips) ....tons..	2,396
Barges	2
Trips	55
Tonnage (55 trips) ....tons..	3,300
Total vessels	7
Total trips	107
Total tonnage (107 trips) ....tons..	5,696

Draft of heaviest vessel—light, 2 feet; loaded, 4 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
Miscellaneous	2,396	$71,880	1,795	$3,300
Cotton and cotton seed	43	3,971	....	....
Lumber, shingles, etc.	54,616	133,735	74,831	135,408
Total	57,055	209,586	76,626	138,708

Increase of 1898 over 1897, 19,571 tons.

U 6.

IMPROVEMENT OF BAYOU COURTABLEAU, LOUISIANA.

The first project for the improvement of Bayou Courtableau was approved in 1879, and provided for the removal of a sand bar at the junction of the bayou and the Atchafalaya River and the establishlishment of slack-water navigation to Washington, La., a distance of 28 miles.

Under this project work was carried on until November 9, 1895, from various appropriations made, aggregating $36,200.

For history and detailed progress of the work see Appendix R, pages 1501 and 1502, Annual Report of Chief of Engineers for 1896.

During the high water of 1896 the backwater from the Atchafalaya River and the current from the Courtableau caused an accumulation of logs, which have accumulated constantly since, until the raft is now about 3 miles long.

Proposals were invited for removing the raft, but no satisfactory bids were received.

Agreement was made with Mr. Ed. C. Pearson for clearing a channel through this raft, the agreement to remain in force until February 28, 1898. Mr. Pearson never attempted to do any work in this direction. (See Appendix S, pages 1762–1763, Annual Report Chief of Engineers for 1897).

There was no commerce on this stream last year, owing to the bayou being totally closed by the log raft.

The amount expended on the improvement of the bayou to June 30, 1898, was $35,476.91.

Money statement.

July 1, 1897, balance unexpended	$3,245.54
June 30, 1898, amount expended during fiscal year	22.25
July 1, 1898, balance unexpended	3,223.29

Abstract of appropriations for improving Bayou Courtableau, Louisiana.

By act of Congress—	
Approved June 14, 1880	$7,500
Approved March 3, 1881	7,500
Approved July 5, 1884	4,000
Approved August 5, 1886	5,000
Passed August 11, 1888	5,000
Approved September 19, 1890	2,200
Passed August 18, 1894	5,000
Passed June 3, 1896	2,500
Total	38,700

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1890	35,867	$4,629,584	1894	9,195	$485,811
1891	32,618	3,917,344	1895	4,095	160,787
1892	20,041	994,471	1896	1,994	103,944
1893	14,848	677,529			

There was no commerce on Bayou Courtableau during the fiscal years 1896–97 and 1897–98 because of the raft obstructing the entrance to the bayou.

U 7.

IMPROVEMENT OF BAYOU TECHE, LOUISIANA.

At the time of the adoption of the present project Bayou Teche was obstructed by snags, logs, and other obstructions. It was cleared in 1886, but other obstructions formed, and the work of removal was continued to May 7, 1895, with appropriations made from time to time, amounting to $61,000.

Over 70 miles of channel were improved by these operations, including dredging of shoal places, and commerce has been greatly benefited.

Under the appropriation of $10,000, made June 3, 1896, contract was entered into October 12 and approved October 27, 1896, for the hire of a dredge to continue the improvement. Under this contract operations were carried on from November 18, 1896, to March 22, 1897, resulting in giving a channel 60 feet wide and averaging 5 feet deep for a distance of about 44½ miles. (See Appendix S, p. 1764, Annual Report of the Chief of Engineers for 1897.)

No work has been done on this stream during the year just closed.

The amount expended on this improvement to June 30, 1898, is $70,639.47.

Money statement.

July 1, 1897, balance unexpended	$420.33
June 30, 1898, amount expended during fiscal year	59.80
July 1, 1898, balance unexpended	360.53

Abstract of appropriations for improving Bayou Teche, Louisiana.

By act of Congress—	
Approved July 11, 1870	$17,500
Approved June 14, 1880	6,000
Approved March 3, 1881	20,000
Approved July 5, 1884	6,500
Approved September 19, 1890	5,000
Passed August 18, 1894	6,000
Passed June 3, 1896	10,000
Total	71,000

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		25
Trips		1,082
Net registered tonnage (1,082 trips)	tons	104,824
Barges		158
Trips		816
Tonnage (816 trips)	tons	145,248
Total vessels		183
Total trips		1,898
Total tonnage (1,898 trips)	tons	250,072

Draft of heaviest vessel, light, 2½ feet; loaded, 8 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Sugar	40,262	$2,498,192	40,037	$2,727,487
Molasses	2,424	37,541	3,443	78,074
Rice	225	10,518	757	30,656
Moss	68	2,734	83	3,309
Pecans	18	726	10	1,580
Hides	20	3,535	14	2,359
Cotton and cotton seed	5,043	228,315	8,992	301,892
Cotton-seed oil	188	11,992	149	6,100
Wood	5,247	5,247	4,406	4,463
Miscellaneous	25,381	135,976	9,253	36,023
Total	78,876	2,934,776	67,144	3,191,943
RECEIPTS.				
Machinery, merchandise, coal, saw logs, etc	224,053	1,168,948	171,639	2,061,124
Grand total	302,929	4,103,724	238,783	5,253,067

Comparative statement of receipts and shipments for seven years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1892	64, 866	$833, 110	1896	293, 685	$4, 269, 695
1893	115, 080	5, 754, 542	1897	303, 029	4, 103, 724
1894	383, 154	7, 378, 789	1898	238, 783	5, 253, 067
1895	279, 928	5, 794, 483			

U 8.

IMPROVEMENT OF CHANNEL, BAY, AND PASSES OF BAYOU VERMILION, LOUISIANA.

No work was done on this stream during the year just closed. For history of the work, details of improvement, and results obtained see Appendix R, pages 1505 and 1506, Annual Report of the Chief of Engineers for 1896.

There was expended during the fiscal year ending June 30, 1898, the sum of $12,442.45.

Money statement.

July 1, 1897, balance unexpended	$1, 112. 42
June 30, 1898, amount expended during fiscal year	54. 87
July 1, 1898, balance unexpended	1, 057. 55
Amount (estimated) required for completion of existing project	11, 500. 00
Amount that can be profitably expended in fiscal year ended June 30, 1900	11, 500. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations for improving channel, bay, and passes of Bayou Vermilion, Louisiana.

By act of Congress—

Approved July 13, 1892	$7, 500
Passed August 18, 1894	5, 000
Passed June 3, 1896	1, 000
Total	13, 500

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		3
Trips		163
Net registered tonnage (163 trips)	tons	5, 381
Barges		8
Trips		246
Tonnage (246 trips)	tons	35, 300
Schooners		5
Trips		5
Net registered tonnage (5 trips)	tons	134
Total vessels		16
Total trips		411
Total tonnage (411 trips)	tons	40, 815

Draft of heaviest vessel: Light, 2½ feet; loaded, 8 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Lumber	120	$7,200	315	$1,680
Rice	278	9,123	297	12,039
Cotton	959	132,150	1,084	121,436
Cotton seed	1,513	21,104	1,556	12,528
Wood	990	1,575	1,600	21,160
Cattle	88	5,016	237	12,130
Sugar	1,242	74,510	1,518	103,438
Merchandise	829	31,140	894	40,759
Molasses	107	1,074	165	385
Coal			1,196	7,820
Total	6,126	282,892	8,862	333,375

Comparative statement of receipts and shipments for five years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1894	43,822	$923,777	1897	6,126	$282,892
1895	12,993	429,172	1898	8,862	333,375
1896	13,022	355,136			

Increase of 1898 over 1897, 2,736 tons.

U 9.

IMPROVEMENT OF MERMENTAU RIVER AND TRIBUTARIES, LOUISIANA.

The present project for the improvement of Mermentau River and its tributaries was approved June 15, 1897, and provided for dredging and the construction of brush dams to secure a channel through Mud Lake 50 feet wide and 6 feet deep.

Under this project contract was entered into with Charles Clarke, of Galveston, Tex., for dredging with the Government plant, and for constructing the brush dam. This contract was approved on November 11, 1897.

Dredging operations were commenced by the contractor on December 24, 1897, and completed on March 4, 1898, resulting in the removal of 26,772 cubic yards of material in a distance of 4,417 feet. This embraced the cutting through of two bars, one at the upper and one at the lower end of Mud Lake. The average depth of both bars is now 8 feet, and average width 50 feet.

Work on the upper dam was commenced on February 3, 1898, and was finished on April 6, 1898. Eight hundred and twenty-two piles were driven in this dam, making it 2,500 feet long and 5 feet wide.

On February 23, 1898, operations were begun on the lower dam, which was completed on April 14, 1898. One thousand piles were driven in this dam, which is now 3,000 feet long.

There has been expended on this improvement to the close of the year ending June 30, 1898, the sum of $16,580.76.

For history and details of the progress of the work on these streams, see Annual Report of the Chief of Engineers for 1896, pages 1507 and 1508.

Money statement.

July 1, 1897, balance unexpended	$10,187.93
June 30, 1898, amount expended during fiscal year	9,268.69
July 1, 1898, balance unexpended	919.24
Amount (estimated) required for completion of existing project	6,115.25
Amount that can be profitably expended in fiscal year ending June 30, 1900	6,115.25

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations for improving Mermentau River and tributaries, Louisiana.

By act of Congress—

Approved July 13, 1892	$7,500
Passed August 18, 1894	5,000
Passed June 3, 1896	5,000
Total	17,500

Abstract of proposals for operating United States dredge and for constructing brush dam in Mud Lake, Louisiana, for improving Mermentau River, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, October 7, 1897.

No.	Name and address of bidder.	For operating United States dredge 72 days (price per day of 8 hours).	5,500 feet brush dams (price per linear foot).	Total.
1	Charles Clarke, Galveston, Tex	$32.00	$1.03	$7,969.00

Contract awarded to Charles Clarke, the lowest and only bidder. Contract approved November 11, 1897. Work was commenced on December 24, 1897, and completed April 14, 1898.

There are no contracts now in force for this work.

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		7
Trips		531
Net registered tonnage (531 trips)	tons	17,398
Barges		11
Trips		257
Net tonnage (257 trips)	tons	10,280
Schooners		5
Trips		120
Net registered tonnage (120 trips)	tons	3,240
Total vessels		23
Total trips		908
Total tonnage (908 trips)	tons	30,918

Draft of heaviest vessel: Light, 3 feet; loaded, 5 feet 7 inches.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
Cotton and cotton seed	858	$49,780	2,134	$23,048
Rice	4,935	165,831	5,699	240,650
Lumber	910	3,550	3,920	14,020
Wood	4,300	10,000	4,500	8,300
Merchandise	1,207	49,125	2,397	64,852
Total	12,210	278,286	18,650	350,870

Increase in 1898 over 1897, 6,440 tons, valued at $72,584.

U 10.

IMPROVEMENT OF MOUTH AND PASSES OF CALCASIEU RIVER, LOUISIANA.

The project under which the present work is being conducted was approved August 17, 1894, and work under it has been continued at intervals since then, the jetty work being done under contract and the dredging with the Government dredge and hired labor.

For details of the progress of the work under this project see Appendix S, Annual Report of the Chief of Engineers for 1897, page 1769.

The operations during the past fiscal year consisted in dredging in the channel from Calcasieu Pass to deep water in Calcasieu Lake, a distance of about 2 miles, in order to restore the dredged channel 50 feet wide and 8 feet deep. Contract was entered into on April 6, 1898, with Charles Clarke & Co., of Galveston, Tex., and approved April 29, 1898, for operating the Government dredge. Work was commenced on May 26, 1898, and is at present being carried on. Up to June 30, 1898, there had been dredged 16,118 cubic feet of material from the channel, and a number of piles removed that had been washed in from the revetment. The dredging in some places has been difficult on account of the slabs and piles that lay in the channel, but the work has progressed steadily.

A breach has been made in the east jetty, and some repairs to same are necessary, since sand drifts through the opening and shoals up the channel.

The sum of $1,863.80 was expended on this improvement during the fiscal year ending June 30, 1898.

Money statement.

July 1, 1897, balance unexpended		$14,887.23
June 30, 1898, amount expended during fiscal year		1,863.80
July 1, 1898, balance unexpended		13,023.43
July 1, 1898, outstanding liabilities	$126.26	
July 1, 1898, amount covered by uncompleted contracts	9,000.00	
		9,126.26
July 1, 1898, balance available		3,897.17
Amount (estimated) required for completion of existing project		255,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		255,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations for improving mouth and passes of Calcasieu River, Louisiana.

By act of Congress—	
Approved June 10, 1872	$15,000
Approved March 3, 1881	15,000
Passed August 2, 1882	10,000
Approved July 5, 1884	6,500
Of August 11, 1888	10,000
Approved September 19, 1890	75,000
Approved July 13, 1892	100,000
Passed August 18, 1894	90,000
Passed June 3, 1896	80,000
Total	401,500

Abstract of proposals for operating United States dredge for improving mouth and passes of Calcasieu River, Louisiana, opened by Maj. James B. Quinn, Corps of Engineers, March 18, 1898.

No.	Name and address of bidder.	Price bid per day of eight hours.
1	Charles Clarke & Co., Galveston, Tex	$29.00
2	Henry Camors, New Orleans, La	29.45

Contract awarded to Charles Clarke & Co., the lowest bidder. Contract approved April 29, 1898. Work was commenced on May 26, 1898, and is being continued at present.

CONTRACT NOW IN FORCE FOR IMPROVING MOUTH AND PASSES OF CALCASIEU RIVER, LOUISIANA.

Dredging in channel from Calcasieu Pass to deep water in Calcasieu Lake, a distance of 2 miles, to restore the dredged channel 50 feet wide and 8 feet deep. Contract entered into April 6, 1898, with Charles Clarke & Co., of Galveston, Tex., approved April 29, 1898. Work commenced on May 26, 1898, and to continue for about three hundred days. Amount to be expended under contract, about $9,000.

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		12
Trips		470
Net registered tonnage (470 trips)	tons	11,255
Barges		22
Trips		185
Tonnage (185 trips)	tons	18,917
Schooners		31
Trips		150
Net registered tonnage (150 trips)	tons	6,041
Total vessels		65
Total trips		805
Total tonnage (805 trips)	tons	36,213

Draft of heaviest vessel, light, 2½ feet; loaded, 8 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
Lumber	129,993	$433,828	171,636	$499,510
Cotton	392	77,975	1,039	21,430
Rice	83	8,691	584	23,679
Merchandise	10,561	144,376	16,758	200,452
Total	141,029	664,870	190,017	745,071

Comparative statement of receipts and shipments for six years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	207,545	$2,141,750	1896	202,775	$691,542
1894	344,973	1,600,574	1897	141,029	664,870
1895	254,394	788,274	1898	190,017	745,071

Increase in 1898 over 1897, 48,988 tons, representing a value of $80,201.

U II.

IMPROVEMENT OF HARBOR AT SABINE PASS, TEXAS.

For history of this work and detailed information relative to the improvements made, see Annual Report of the Chief of Engineers for 1896, pages 1512 to 1514. Also Appendix S, Annual Report of the Chief of Engineers for 1897, page 1771.

The river and harbor act of June 3, 1896, authorized contracts to be entered into for such materials and labor necessary to complete the present project of improvement, limiting the cost to $1,050,000.

The sundry civil act approved June 4, 1897, appropriated $350,000 for improvement under the continuous contract system outlined above, $100,000 for the purchase of a dredge boat and $30,000 for operating same during the fiscal year ending June 30, 1898.

The project approved by the Secretary of War December 8, 1896, provides for constructing 5,300 linear feet, more or less, of the east jetty, and 6,600 linear feet, more or less, of the west jetty, at a cost of $985,000, and that $65,000 be set aside for the enlargement and maintenance of the dredged channel.

The project for the expenditure of $130,000, appropriated by sundry civil act approved June 4, 1897, for purchasing and operating a dredge, was approved June 29, 1897.

Contract was entered into May 10, 1897, and approved June 23, 1897, with Messrs. Christie & Lowe, of Chicago, Ill., for the extension of the east and west jetties, and for deepening the channel by dredging. Operations were commenced by the contractors on August 10, 1897, and on June 30, 1898, the work done consisted in dredging of 299,799.75 cubic yards of material in channel, the placing of 42,277.98 square yards of brush mattress, 74,595.25 tons of riprap stone and 235.21 tons of granite capping stone on the east jetty, extending same 4,100 feet, of which about 2,000 feet have been brought up to mean low water of the Gulf.

The west jetty was capped with 9,647.19 tons of granite blocks, and 193.28 tons of riprap stone placed on it, completing same for a distance of about 3,000 feet.

A severe storm occurred on the Gulf coast on September 12, 1897, which resulted in some damage to the contractors. The Government only sustained slight damage to two naphtha launches.

On October 18, 1897, proposals for building a dredge boat and scow were opened, but all bids were rejected as not conforming to specifications. New plans and specifications have been prepared and forwarded for approval.

Act of Congress approved March 17, 1898, makes available after June 30, 1898, $15,000 of the $30,000 appropriated by sundry civil act approved June 4, 1897.

Under project approved March 29, 1898, contract was entered into June 15, 1898, with the National Dredging Company, Wilmington, Del., for dredging in the channels, and forwarded for approval.

The amount expended on this improvement for the fiscal year ending June 30, 1898, is $191,106.56.

The following is an estimate of this work carried on under the provisions of the continuing contract system, as outlined above:

Amount of continuous contract authorized in act of June 3, 1896		$1,050,000.00
Amount appropriated by sundry civil act approved June 4, 1897	$350,000	
Amount appropriated by sundry civil act approved July 1, 1898	400,000	
		750,000.00
Balance unappropriated		300,000.00
Amount required for fiscal year ending June 30, 1900		300,000.00
Based on the following estimate for completion of west jetty, 3,100 feet:		
43,055.58 square yards brush mattress, at 68 cents		29,277.80
134,663.64 tons riprap stone, at $1.67		224,882.80
12,063.00 tons granite stone, at $3.80		45,839.40
Total		300,000.00

Money statement.

July 1, 1897, balance unexpended		$552,506.49
Amount appropriated by sundry civil act approved July 1, 1898		400,000.00
		952,506.49
June 30, 1898, amount expended during fiscal year		191,106.56
July 1, 1898, balance unexpended		761,399.93
July 1, 1898, outstanding liabilities	$45,495.97	
July 1, 1898, amount covered by uncompleted contracts	*534,970.82	
		580,466.79
July 1, 1898, balance available		180,933.14
Amount (estimated) required for completion of existing project		300,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900		300,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867, and of sundry civil act of June 4, 1897.		

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* The approved continuous contract calls for the expenditure of $1,050,000.

Abstract of appropriations for improving harbor at Sabine Pass, Tex.

From act approved August 30, 1852 (survey)	$5,000
Allotted from act approved June 10, 1873 (survey)	2,000
By act of Congress—	
Approved March 3, 1875	20,000
Approved August 14, 1876	38,000
Approved June 18, 1878 (allotted)	30,000
Approved March 3, 1879	25,000
Approved June 14, 1880	50,000
Approved March 3, 1881	150,000
Passed August 2, 1882	150,000
Approved July 5, 1884	200,000
Approved August 5, 1886	198,750
Of August 11, 1888	250,000
Approved September 19, 1890	300,000
Approved July 13, 1892	350,000
Of August 18, 1894	*271,000
Of June 3, 1896	75,000
Sundry civil act approved June 4, 1897	480,000
Sundry civil act approved July 1, 1898	400,000
Total	2,994,750

Abstract of proposals for building a dredge boat and a scow, for improving harbor at Sabine Pass, Tex., opened October 18, 1897, by Maj. James B. Quinn, Corps of Engineers.

No.	Name and address of bidder.	Building dredge-boat.	Building scow.	Total bid.
1	Petersburg Iron Works Co., Petersburg, Va	$84,900	....	$84,900
2	The Bucyrus Co., South Milwaukee, Wis.:			
	Specifications No. 404 (wood hull)	95,000	....	95,000
	Specifications No. 404 (steel hull)	108,000	....	108,000
	Specifications No. 405 (wood hull)	76,000	....	76,000
	Specifications No. 405 (steel hull)	86,000	....	86,000
	Specifications No. 405 (wood, 2 hoppers)	78,500	....	78,500
	Specifications No. 405 (steel, 2 hoppers)	88,000	....	88,000

The above bids were rejected as not conforming to specifications and plans.

Abstract of proposals for dredging at Sabine Pass, Tex., opened May 27, 1898, by Maj. James B. Quinn, Corps of Engineers.

[135,000 cubic yards.]

No.	Name and address of bidder.	Rate per cubic yard.	Total amount bid.
1	National Dredging Co., Wilmington, Del	$0.13	$17,550.00

Contract entered into June 15, 1898. Approved July 7, 1898.

CONTRACTS NOW IN FORCE FOR IMPROVING HARBOR AT SABINE PASS, TEX.

For extension of jetties and for dredging under the continuing contract system; name of contractors, Christie & Lowe, Chicago, Ill.; date of approval, June 22, 1897. Work was commenced on August 10, 1897; dredging part of contract was completed in October, 1897; the entire work under contract to be completed on or before May 31, 1901.

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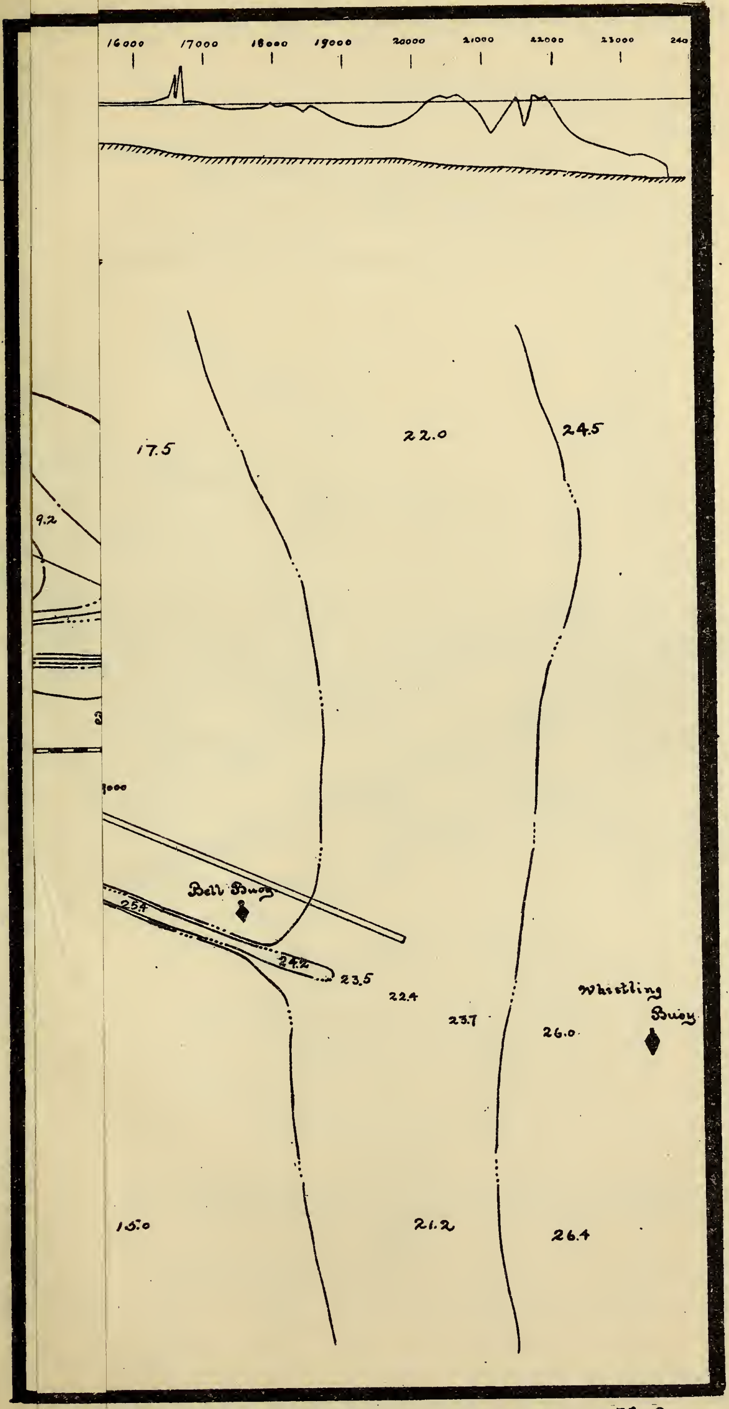
*The total amount of this appropriation was originally $275,000, but of this sum $4,000 was allotted by sundry civil act of March 2, 1895, for dredging of a bar across the mouth of Sabine River, Texas, and was expended under that improvement.


16000
17000
18000
19000
20000
21000
22000
23000
240
17.5
22.0
24.5
9.2
Bell Buoy
25.4
24.2
23.5
22.4
23.7
26.0
Whistling Buoy
15.0
21.2
26.4

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Abstract of appropriations for improving harbor at Sabine Pass, Tex.

From act approved August 30, 1852 (survey)	$5,000
Allotted from act approved June 10, 1873 (survey)	2,000
By act of Congress—	
Approved March 3, 1875	20,000
Approved August 14, 1876	38,000
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Approved March 3, 1879	25,000
Approved June 14, 1880	50,000
Approved March 3, 1881	150,000
Passed August 2, 1882	150,000
Approved July 5, 1884	200,000
Approved August 5, 1886	198,750
Of August 11, 1888	250,000
Approved September 19, 1890	300,000
Approved July 13, 1892	350,000
Of August 18, 1894	*271,000
Of June 3, 1896	75,000
Sundry civil act approved June 4, 1897	480,000
Sundry civil act approved July 1, 1898	400,000
Total	2,994,750

Abstract of proposals for building a dredge boat and a scow, for improving harbor at Sabine Pass, Tex., opened October 18, 1897, by Maj. James B. Quinn, Corps of Engineers.

No.	Name and address of bidder.	Building dredge-boat.	Building scow.	Total bid.
1	Petersburg Iron Works Co., Petersburg, Va	$84,900		$84,900
2	The Bucyrus Co., South Milwaukee, Wis.:			
	Specifications No. 404 (wood hull)	95,000		95,000
	Specifications No. 404 (steel hull)	108,000		108,000
	Specifications No. 405 (wood hull)	76,000		76,000
	Specifications No. 405 (steel hull)	86,000		86,000
	Specifications No. 405 (wood, 2 hoppers)	78,500		78,500
	Specifications No. 405 (steel, 2 hoppers)	88,000		88,000

The above bids were rejected as not conforming to specifications and plans.

Abstract of proposals for dredging at Sabine Pass, Tex., opened May 27, 1898, by Maj. James B. Quinn, Corps of Engineers.

[135,000 cubic yards.]

No.	Name and address of bidder.	Rate per cubic yard.	Total amount bid.
1	National Dredging Co., Wilmington, Del	$0.13	$17,550.00

Contract entered into June 15, 1898. Approved July 7, 1898.

CONTRACTS NOW IN FORCE FOR IMPROVING HARBOR AT SABINE PASS, TEX.

For extension of jetties and for dredging under the continuing contract system; name of contractors, Christie & Lowe, Chicago, Ill.; date of approval, June 22, 1897. Work was commenced on August 10, 1897; dredging part of contract was completed in October, 1897; the entire work under contract to be completed on or before May 31, 1901.

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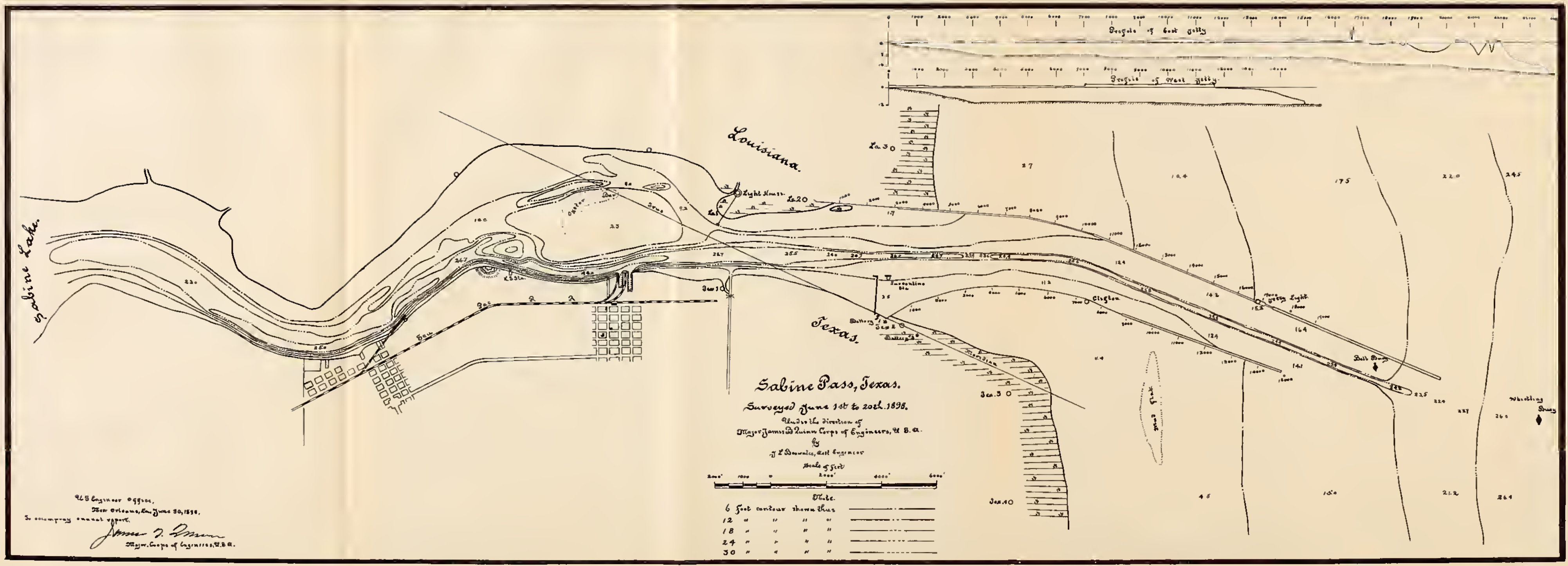
*The total amount of this appropriation was originally $275,000, but of this sum $4,000 was allotted by sundry civil act of March 2, 1895, for dredging of a bar across the mouth of Sabine River, Texas, and was expended under that improvement.



Sabine Pass, Texas.

Surveyed June 1st to 20th. 1898.

Under the direction of
Major James B. Quinn Corps of Engineers, U. S. A.
by
J. L. Brownlee, Asst. Engineer

Scale of feet

2000' 1000 0 2000' 4000' 6000'

Note.

6 foot contour shown thus
12 " " " "
18 " " " "
24 " " " "
30 " " " "

U. S. Engineer Office,
New Orleans, La. June 30, 1898.
To accompany annual report.

James B. Quinn
Major, Corps of Engineers, U. S. A.

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COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Vessels		137
Trips		809
Net registered tonnage (809 trips)	tons..	195, 330

The deepest draft vessel passing out this year was loaded to 24 feet 6 inches, and did not touch bottom anywhere.

Shipments and receipts for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
SHIPMENTS.				
Lumber	80, 953	$433, 213	144, 491	$636, 161
Merchandise	33	3, 150	3, 415	165, 430
Cotton and cotton-seed products			4, 054	355, 317
Wheat and corn, in bulk			11, 121	328, 000
Flour and meal			9, 628	390, 526
Meat and lard			1, 131	124, 950
Total	80, 986	436, 363	173, 840	2, 000, 384
RECEIPTS.				
Rock	4, 520	8, 626	53, 800	111, 146
Coal	1, 542	6, 939	3, 346	13, 384
Merchandise	584	23, 360	7, 414	238, 628
Grand total	87, 632	475, 288	238, 400	2, 363, 542

Comparative statement of receipts and shipments for six years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	15, 050	$180, 950	1896	48, 886	$199, 042
1894	40, 966	280, 189	1897	87, 632	475, 288
1895	47, 691	252, 823	1888	238, 400	2, 363, 542

Increase of 1898 over 1897, 150,768 tons, representing a value of $1,888,254.

There were two new lines of steamships established during the year at Sabine Pass.

U 12.

IMPROVEMENT OF SABINE RIVER, TEXAS.

No work was done on this stream during the year just closed. For details of the improvement and history of this work see pages 1515 to 1517, Annual Report of the Chief of Engineers for 1896.

Under project approved June 9, 1897, it was contemplated to clear the river of obstructions from Morgans Bluff to the head of the Narrows. Bids for doing this work were asked in August, 1897, but none were received.

The amount expended on this improvement to June 30, 1898, was $48,692.43.

Money statement.

July 1, 1897, balance unexpended	$2,126.23
June 30, 1898, amount expended during fiscal year	118.66
July 1, 1898, balance unexpended	2,007.57
July 1, 1898, outstanding liabilities	16.67
July 1, 1898, balance available	1,990.90
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	* 2,000.00

Abstract of appropriations for improving Sabine River, Texas.

Allotted from act approved June 10, 1872	$2,700
By act of Congress—	
Approved June 18, 1878	10,000
Approved March 3, 1879	6,000
Approved June 14, 1880	5,000
Approved March 3, 1881	7,000
Passed August 2, 1882	4,000
Approved July 13, 1892	5,000
Passed August 18, 1894	5,000
Passed June 3, 1896	2,000
Total	46,700
Amount allotted from appropriation of $275,000 for improving Sabine Pass, Texas, by sundry civil act of March 2, 1895, and expended under this appropriation	4,000
Total	50,700

The above amount was allotted for dredging bar across the mouth of Sabine River from the appropriation dated August 17, 1894, for improving Sabine Pass, Texas, and the work was done by the Government dredge and hired labor.

COMMERCIAL STATISTICS.

[From June 1, 1897, to May 31, 1898.]

Steamers		20
Trips		553
Net registered tonnage (553 trips)	tons	10,650
Schooners		15
Trips		50
Net registered tonnage (50 trips)	tons	1,201
Barges		24
Trips		391
Tonnage (391 trips)	tons	33,359
Total vessels		59
Total trips		994
Total tonnage (994 trips)	tons	45,210

Draft of heaviest vessel—light, 2½ feet; loaded, 7 feet.

Receipts and shipments for two years.

Articles.	Year ending May 31—			
	1897.		1898.	
	Tons.	Value.	Tons.	Value.
Lumber	234,812	$684,004	263,825	$748,857
Cotton	950	136,800	226	25,256
Staves	450	1,750	8,453	505,946
Wood	40	9,600		
Merchandise	9,112	349,000	3,002	114,498
Total	245,364	1,181,154	275,506	1,394,557

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* The estimate submitted is for maintenance, $2,000 being required annually.

Comparative statement of receipts and shipments for six years.

Year ending May 31—	Tons.	Value.	Year ending May 31—	Tons.	Value.
1893	146,363	$1,591,280	1896	271,257	$979,380
1894	245,657	1,518,630	1897	245,364	1,181,154
1895	182,738	736,044	1898	275,506	1,394,557

Increase of 1898 over 1897, 30,142 tons.

U 13.

CLOSING CREVASSE IN PASS A LOUTRE, MISSISSIPPI RIVER.

An act of Congress, approved February 26, 1897, appropriated $250,000 for the closure of this crevasse.

On November 18, 1896, Pass a Loutre crevasse was 2,230 feet wide. The project approved by the Chief of Engineers, on June 16, 1897, provides for the closure of the crevasse with Wakefield sheet piling, properly backed with a double row of piles, securely braced, fastened, and bolted to stringers and the sheet piling, using a third row of brace piles where the depth of water exceeds 20 feet. If a protection to the toe of the sheet piling became necessary to prevent undermining by wave action, a brush mat, weighted with stone, is to be provided. The dam is to be 6,650 feet long, in two sections, 1,900 and 4,750 feet in length, respectively, forming an angle of 112° at a distance of 3,000 feet below the mouth of the crevasse. (Plan and section of work herewith.)

Proposals for closing the crevasse under this project were opened in September, 1897. Messrs. James Stewart & Co., of St. Louis, Mo., were the lowest bidders, and contract was entered into with them on October 29, 1897, and approved December 10, 1897. The contractors were much delayed in commencing work on account of quarantine restrictions. The work of driving piles began December 14, 1897, and on January 27, 1898, there were 2,400 feet of the dam completed. By this time the river had reached such a high stage and the current became so strong as to render further work impracticable, and an extension of time to October 31, 1898, was granted the contractors in which to complete the work.

On January 27, 1898, a portion of the sheet-piling dam, where the piling penetrated a quicksand pocket, was undermined and blew out at the bottom, carrying away 123 feet of finished work, about the middle of that completed. This sheet-piling dam had not been accepted by the Government, and was lost by the contractors. The width of the break increased from time to time, and on June 23, 1898, was 492½ feet. Much of the latter, which washed away, had been accepted by the Government.

On May 1 the extreme east end of the work began to undermine, and 29½ feet have been lost from that end. This makes a total of 522 feet of completed work which has been lost, leaving 1,878 feet now in place.

The location of the dam is given on a chart herewith, and a note thereon gives details of its condition, the number of feet to be built, etc.

A supplemental contract was entered into with the contractors on April 19, 1898, and approved by the Secretary of War on June 14, 1898, for additional work on the Pass a Loutre dam, at original contract prices. The work embraced in the supplemental contract is as follows: 1,000 feet sheet-piling dam, 20 feet long; 1,000 feet of sheet-piling dam, 40 feet long; 1,000 feet of double row of bracing, 20 feet long; 1,000 feet of triple-row bracing, 40 feet long.

The additional work has been rendered necessary by the washing away of part of the completed dam, and the scour of the current at the base of the piling being so strong as to require the use of longer piling in some places than originally contemplated.

The contractors will shortly renew operations on closing the crevasse, under original and supplemental contracts.

The amount expended on this work to the close of the fiscal year ending June 30, 1898, is $70,672.82.

Act approved February 17, 1898, provides for a survey and report, by a Board of Engineer Officers, upon the practicability of securing a channel of adequate width and of 35 feet depth, at mean low water of the Gulf of Mexico, throughout Southwest Pass of the Mississippi River. The sum of $10,000 was allotted for this survey from the appropriation for closing crevasse in Pass a Loutre, Mississippi River.

The survey was commenced on March 24, 1898, and practically completed on April 15, 1898. The large party and plant were then transferred to the Mississippi River Commission, from whom they were borrowed, and a small party organized and set to work on April 26 to obtain daily discharge measurements of Southwest Pass, accompanied by measurements of South Pass and Pass a Loutre; also an occasional measurement of the Jump and Cubitts Gap. This work to continue until the river reaches a low-water stage.

The field work of the Southwest Pass survey is now being reduced and platted in office.

Money statement.

July 1, 1897, balance unexpended		$250,000.00
June 30, 1898, amount expended during fiscal year		70,672.82
July 1, 1898, balance unexpended		179,327.18
July 1, 1898, outstanding liabilities	$8,711.80	
July 1, 1898, amount covered by uncompleted contracts	121,496.04	
		130,207.84
July 1, 1898, balance available		49,119.34

Abstract of proposals for closing crevasse in Pass a Loutre, Mississippi River, opened September 25, 1897, by Maj. James B. Quinn, Corps of Engineers.

No.	Name and address of bidder.	Amount of bid.
1	Henry Camors, New Orleans, La	$151,580
2	W. O. Flynn & Co., New Orleans, La	[a] 159,315
3	James Stewart & Co., St. Louis, Mo	136,015
4	Charles Clarke & Co., Galveston, Tex	[b] 149,980

[a] Informal; no guaranty accompanying proposal. [b] Informal; telegraphic bid.

Contract awarded to James Stewart & Co., St. Louis, Mo., the lowest bidder; approved December 10, 1897. Work began December 14, 1897, and continued until January 27, 1898, when it was discontinued on account of high water in the river. An extension of time to complete the work was granted to October 31, 1898.

CONTRACTS NOW IN FORCE FOR CLOSING CREVASSE IN PASS A LOUTRE, MISSISSIPPI RIVER.

For closing crevasse in Pass a Loutre, Mississippi River; name of contractors, James Stewart & Co., St. Louis, Mo.; date of approval, December 10, 1897; work commenced December 14, 1897, to be completed October 31, 1898.

23
23
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The additional work has been rendered necessary by the washing away of part of the completed dam, and the scour of the current at the base of the piling being so strong as to require the use of longer piling in some places than originally contemplated.

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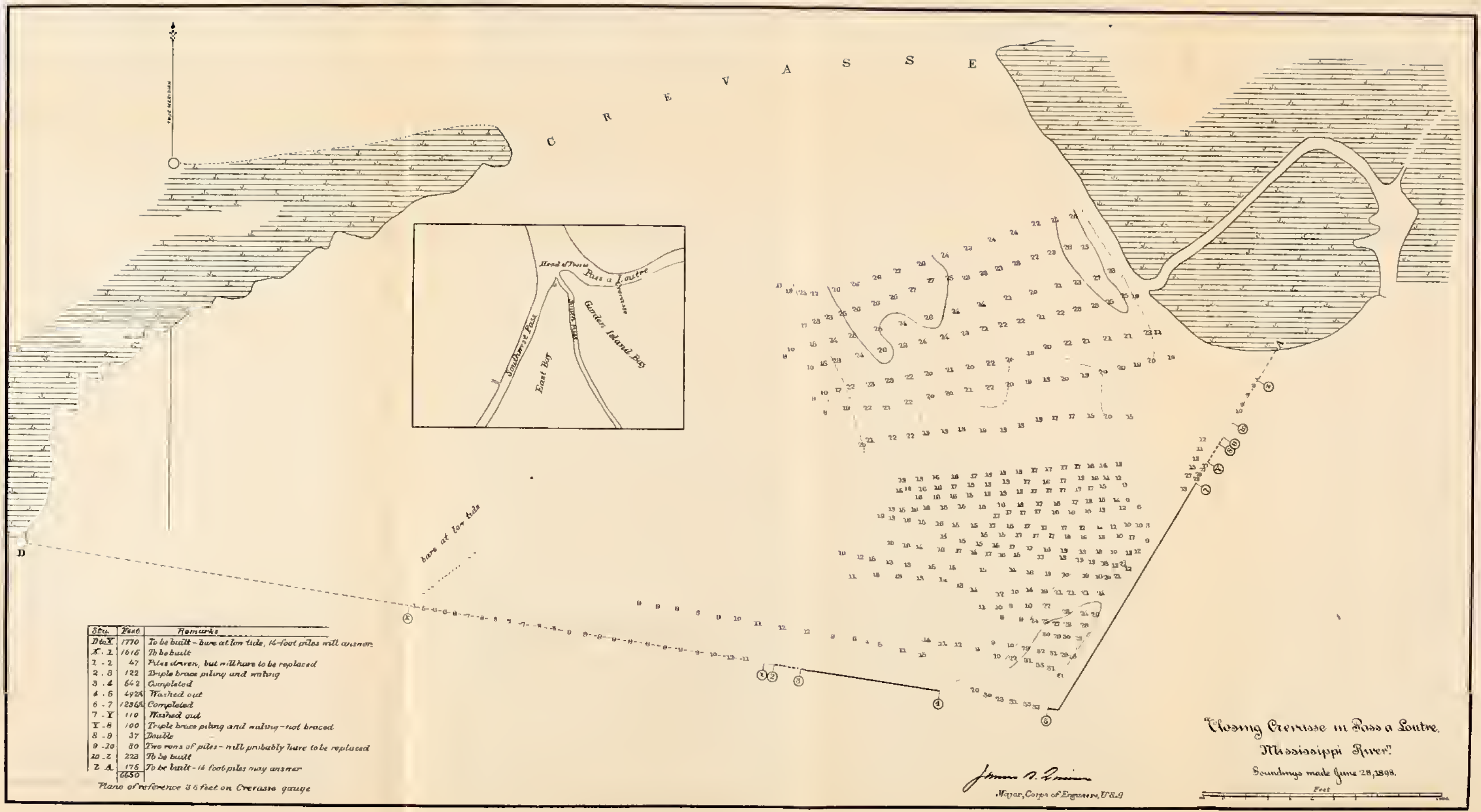
CONTRACTS NOW IN FORCE FOR CLOSING CREVASSE IN PASS A LOUTRE, MISSISSIPPI RIVER.

For closing crevasse in Pass a Loutre, Mississippi River; name of contractors, James Stewart & Co., St. Louis, Mo.; date of approval, December 10, 1897; work commenced December 14, 1897, to be completed October 31, 1898.



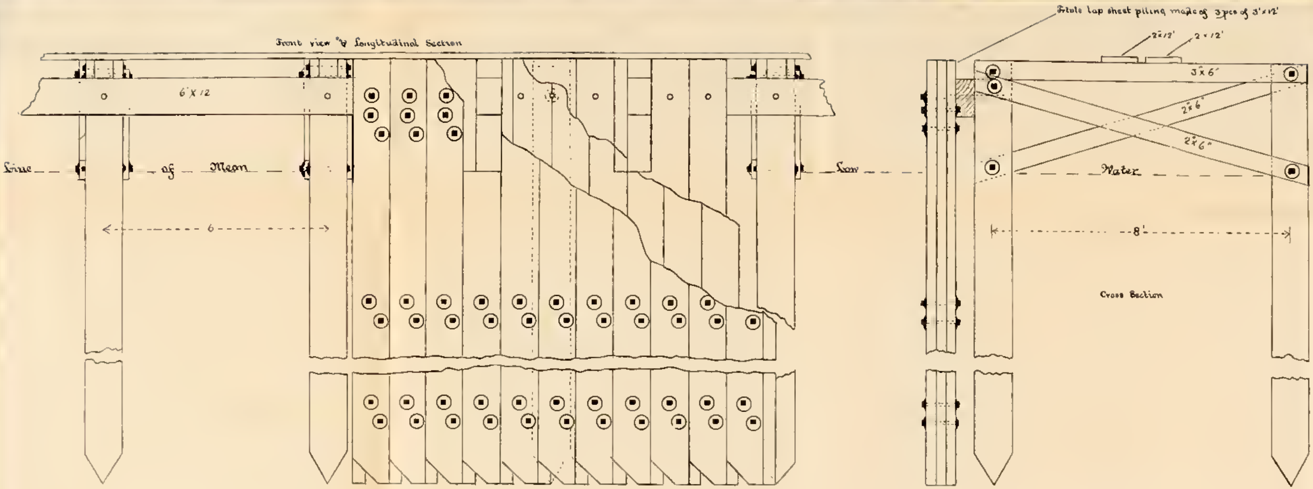
"Closing Crevasse in Pass a Loutre, Mississippi River."

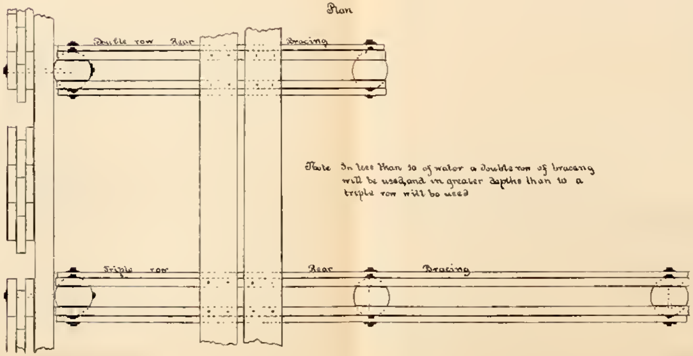
Soundings made June 28, 1898.

Sta.	Feet	Remarks
D to X	1770	To be built – bare at low tide, 14-foot piles will answer.
X . 1	1616	To be built
1 - 2	47	Piles driven, but will have to be replaced
2 . 3	122	Triple brace piling and waling
3 . 4	642	Completed
4 . 5	492½	Washed out
5 - 7	1236½	Completed
7 - Y	110	Washed out
Y - 8	100	Triple brace piling and waling – not braced
8 - 9	37	Double
9 - 10	80	Two rows of piles – will probably have to be replaced
10 - Z	223	To be built
Z A	175	To be built – 14 foot piles may answer
	6650	

Plane of reference 3.6 feet on Crevasse gauge

James B. Quinn
Major, Corps of Engineers, U.S.A.


Front view & Longitudinal Section
6"x12
Line of Mean Low Water
6
Triple lap sheet piling made of 3 pcs of 3"x12"
2"x12"
2"x12"
3"x6"
2"x6"
2"x6"
8'
Cross Section



Note In less than 10 of water a double row of bracing will be used, and in greater depths than 10 a triple row will be used

# Plan of Sheet Piling Dam
for closing
Crevasse in Pass à Loutre, La

Scale of feet
0 1 2 3 4 5

James B. Quinn
Major, Corps of Engineers, U.S.A.

Supplemental contract entered into with James Stewart & Co., St. Louis, Mo., April 19, 1898, approved by the Secretary of War June 14, 1898, for additional work on the Pass a Loutre Dam, at original contract prices. Amount of contract $45,450.

U 14.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of barge in Lake Pontchartrain, Louisiana.—This wreck formed an obstruction to navigation in Lake Pontchartrain, Louisiana, having sunk in 12 feet of water bearing west by north from the Picketts. Its removal was authorized by the Secretary of War January 12, 1897, and an allotment of $1,500 made therefor from the permanent indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation.

Contract was entered into and approved May 1, 1897, with Mr. James Moore, of New Orleans, to remove the wreck for the sum of $345. Work was commenced on May 5, 1897. On or about June 15, 1898, the contractor left the scene of operations, and the completion of the contract was undertaken by one of the bondsmen. The work was satisfactorily completed on July 28, 1897, three days before the expiration of the contract.

U 15.

PLAN AND ESTIMATE OF COST OF IMPROVEMENT OF HOMOCHITTO RIVER, MISSISSIPPI.

[Printed in House Doc. No. 404, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, April 1, 1898.

SIR: I have the honor to acknowledge the receipt of concurrent resolution passed by the House of Representatives March 17, 1898, and agreed to by the Senate March 21, 1898, directing the Secretary of War "to furnish and report a plan for the improvement of the Homochitto River, in the State of Mississippi, from and including its mouth to the Yazoo and Mississippi Valley Railroad, together with estimates of the cost of making such improvement in accordance with said plans."

In reply to the reference of this resolution to this office for report I have to state that Maj. James B. Quinn, Corps of Engineers, the local officer who made preliminary examination of this stream under provisions of the river and harbor act of June 3, 1896, estimates that the obstructing snags and impending trees can be cleared out so as to give navigation on this river between its mouth and the Yazoo and Mississippi Valley Railroad for boats drawing not more than 6 feet of water for the sum of $16,000.

The concurrent resolution is herewith returned.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

APPENDIX V.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, MAJ. JAMES B. QUINN AND CAPT. CHARLES S. RICHÉ, CORPS OF ENGINEERS.

IMPROVEMENTS.

1. Galveston Harbor, Texas.
2. Ship channel in Galveston Bay, Texas.
3. Operating and care of Morgans Canal, Texas.
4. Channel in West Galveston Bay, Texas.
5. Trinity River, Texas.
6. Buffalo Bayou, Texas.
7. Brazos River, Texas.

SURVEYS.

8. Mouth of Double Bayou on east side of Galveston Bay, Texas.
9. For channel from mouth of the jetties at Galveston, Tex., through existing ship channel and up Buffalo Bayou to Houston.
10. Character and value of improvements made at the Pass of Aransas, Texas, by the Aransas Pass Harbor Company.

HARBOR LINES.

11. Galveston Harbor, Texas.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., July 21, 1898.

GENERAL: I have the honor to forward herewith annual reports on river and harbor improvements under my charge * * * for the fiscal year ending June 30, 1898, as follows:

* * * * * * *

Very respectfully, your obedient servant,

JAMES B. QUINN,
Major, Corps of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.

V 1.

IMPROVEMENT OF GALVESTON HARBOR, TEXAS.

This work is being carried on under a project formulated by a Board of Engineers January 21, 1886, the report on which may be found in the Annual Report of the Chief of Engineers for 1886, page 1294 et seq.

At the close of the last fiscal year South Jetty had been completed. The construction of North Jetty, under contract of O'Connor, Laing & Smoot, and dredging by U. S. dredge *General C. B. Comstock*, were in progress. At that time the South Jetty had been completed for a distance of 35,603 feet, of which 803 feet was a riprap apron, and the North Jetty had been completed for a distance of 24,700 feet and partially completed for a distance of 1,027 feet. These jetties are built of riprap, covered with granite blocks, and are carried to an elevation of 5 feet above mean low tide. The general method of constructing the jetties is described on page 1530, Annual Report of the Chief of Engineers for 1892, and page 1392, Annual Report of the Chief of Engineers for 1894. The abstracts of proposals, giving prices paid for the different parts of the work, will be found on pages 1878 and 1879, Annual Report of the Chief of Engineers for 1891.

During the present fiscal year the construction of North Jetty by contract was continued, and the *Comstock* kept at work dredging along the line of the channel.

SOUTH JETTY.

The construction of this jetty was considered complete on February 14, 1897, when the work was suspended, the jetty having been completed according to the original designs of this office. Under date of April 14, 1897, the Department decided that the length of apron to protect completed jetty should be 300 feet. This decision necessitated the repairs of construction trestle and track and the building up of 500 feet of jetty to its full height, 5 feet above mean low tide.

The contractor refusing to take advantage of the above decision, no work was done. The contract was finally closed May 30, 1898.

NORTH JETTY.

The advance during the year was 500 feet of completed work, making the total length 25,907 feet, of which 307 feet is a riprap apron. On January 29, 1898, this jetty was considered complete according to the original designs of this office, and in conformity with the decisions of the Department of April 14, 1897, that the length of riprap apron should be diminished to 307 feet.

DREDGING.

During the year the U. S. dredge *General C. B. Comstock* worked seven and one-third months with a single crew, three and one-third months with a double crew, and one and one-third months laid up for extraordinary repairs. A description of the dredge *Comstock* will be found on pages 1530–1531, Annual Report of the Chief of Engineers, 1896; also cost of dredging in Annual Report of the Chief of Engineers, 1897, page 1795.

Dredging has been principally confined to the channel between the jetties, which has been deepened, widened, and straightened. When too rough to work in this channel the inner-bar channel, at the entrance to Galveston Channel, has been widened.

The total amount of material removed during the year was 562,976 cubic yards, of which 146,462 cubic yards were taken from the outer bar, 363,112 cubic yards from the bar channel, and 53,402 from the inner bar.

A detailed account of work done on jetties and dredging will be found in the report of Mr. E. M. Hartrick, assistant engineer, forwarded herewith, and to which attention is invited.

TIDAL OBSERVATIONS.

Two automatic tide gauges were in operation during the year. A third, the bar gauge, was kept in working order until February 18, 1898, when it was found necessary to have it repaired. After the repairs were completed it was not put in operation on account of the boat for this particular service being engaged on torpedo work.

STORMS.

The only storm of any consequence occurred on the 14th of October, 1897, damaging the trestle and track at outer end of North Jetty, and carrying away more of the abandoned trestle and track of South Jetty.

SURVEYS.

Surveys have been more or less suspended, owing to the urgency of work on fortifications. The office and field force, together with the survey boat, have been engaged on the works of national defense (War).

The annual survey has been limited to the outer-bar channel and shows no marked gain in depth, but a considerable better navigable channel, with 25½ feet least depth.

A resurvey of Galveston Bay has been commenced. The triangulation plan has been more or less perfected and the sites of proposed stations visited. A new base line has been measured and partially computed. Attention is called to accompanying reports of Messrs. E. M. Hartrick and L. C. Sabin, assistant engineers.

Amount expended on this project to June 30, 1897	$7,901,364.89
Amount expended during the fiscal year	349,801.58
Total amount expended to June 30, 1898	8,251,166.47

Money statement.

July 1, 1897, balance unexpended	$576,935.11
June 30, 1898, amount expended during fiscal year	349,801.58
July 1, 1898, balance unexpended	227,133.53
July 1, 1898, outstanding liabilities	14,840.95
July 1, 1898, balance available	212,292.58

Abstract of appropriations made by Congress for improving harbor at Galveston, Tex.

By act of—		By act of—	
July 11, 1870	$25,000	August 11, 1888	$500,000
March 3, 1871	20,000	September 19, 1890	500,000
June 10, 1872	31,000	March 3, 1891	600,000
June 23, 1874	60,000	August 5, 1892	450,000
March 3, 1875	150,000	March 3, 1893	1,000,000
August 14, 1876	142,000	August 18, 1894	600,000
June 7, 1878	75,000	January 25, 1895	200,000
June 18, 1878	50,000	March 2, 1895	1,160,000
March 3, 1879	100,000	February 26, 1896	300,000
June 14, 1880	175,000	June 3, 1896	50,000
March 3, 1881	250,000	June 11, 1896	840,000
March 4, 1882	100,000	June 4, 1897	500,000
August 2, 1882	300,000		
August 5, 1886	300,000	Total	8,478,000

In addition to the above appropriations by Congress, there has been collected from steamship *Maritime*	300
Total	8,478,300

COMMERCIAL STATISTICS OF GALVESTON HARBOR, TEXAS, FOR FISCAL YEAR ENDING JUNE 30, 1898.

Tonnage of vessels and revenue collected.

	Steam vessels.	Sailing vessels.	Total.	Total tonnage.
Entered	582	76	658	1,069,233
Cleared	593	63	656	1,093,285
Total	1,175	139	1,314	2,162,518

Duties on imports collected	$127,136.12
All moneys collected at custom-house	171,765.33

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton (1,933,150 bales)	413,553	$59,650,641
Cotton products	217,037	5,472,919
Ore	3,370	340,297
Wool	6,406	768,693
Grain	359,097	12,049,762
Sugar	7	478
Coal	169,002	460,175
General merchandise	1,761,592	15,853,328
Total	2,930,064	94,596,293

Increase of freight compared with last year ....tons.. 1,720,242

Comparative statement for fiscal years 1896 to 1898.

Articles.	1896.	1897.	1898.
Cotton ....tons..	249,227	378,335	413,553
Cotton products ....do...	112,350	162,790	217,037
Ore ....do...	1,514	12,473	3,370
Wool ....do...	6,031	5,423	6,406
Grain ....do...	127,602	272,340	359,097
Sugar ....do...	3,207	1,133	7
Coal ....do...	141,230	142,092	169,002
General merchandise ....do...	131,435	235,216	1,761,592
Total tons	772,596	1,209,822	2,930,064
Total value	$46,490,800	$68,261,553	$94,596,293

REPORT OF MR. E. M. HARTRICK, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., July 6, 1898.

MAJOR: I have the honor to submit the following report of operations for improving Galveston Harbor during the fiscal year ending June 30, 1898:

SOUTH JETTY.

No work was done on South Jetty during the year, as it was considered complete. To prevent encroachment of the waters of the bay and the possible erosion and undermining of the shore branch, 535.72 tons of sand-stone riprap were placed as a revetment between Stations No. 69 and No. 74 on the bay front.

NORTH JETTY.

At the beginning of the fiscal year the North Jetty was completed to Station 250, riprap mound to mean low tide at Station 250, apron at Station 259 + 07.

On January 29, 1898, work was suspended and the jetty considered complete to Station 256, with an apron of 307 feet to Station 259 + 07, an advance of only 600 feet in seven months. This was due to the length of time required to make the necessary repairs after the storm of March 28, 1897, which caused damage to 6,200 feet of trestle, leaving about 3,500 feet to be repaired in this fiscal year before riprap could be unloaded. The unloading recommenced on the 24th of August, 1897, but was more or less retarded by equinoctial gales and boisterous weather during the winter of 1897 and 1898.

Table showing kind and amount of stone placed in North Jetty.

Month.	Riprap.		Blocks.		Total cars.
	Cars.	*Tons.*	*Cars.*	*Tons.*	
1897.					
July	47	1,123.92	60	1,551.46	107
August	38	864.04	62	1,581.43	100
September	144	3,232.32	171	4,547.32	315
October	272	6,107.15	130	3,227.89	402
November	285	6,330.51	195	4,925.25	480
December	119	2,599.88	259	6,498.46	378
1898.					
January	83	1,653.87	127	3,114.84	210
Total	988	21,911.69	1,004	25,446.65	1,992

CONDITION OF THE WORK.

The condition of both jetties remains about the same. The subsidence and consolidation continue, but to what amount is not determined, as there were no levels run or cross sections taken for this report, the field force being engaged on fortifications.

A storm on October 14, 1897, damaged trestle and track at outer end of North Jetty, which necessitated repairs to underpinning of track between Stations 80 and 190. The same storm carried away considerable of the old trestlework and track used in construction of South Jetty.

On the 21st of March, 1898, authority was given by telegraph to dismantle North Jetty trestle and track; but, owing to unfavorable weather and crippling of the contractors' plant by the sale of their tugboat *Hortense* to the Navy Department, the work was delayed, but was finally completed on the 15th of June, 1898. Four hundred and ninety-eight and eight-tenths tons of rails and 696,780 feet of lumber were removed from the jetty and are being used on fortifications.

INSPECTION, CONSTRUCTION, TRANSFER, AND BARGE LINE.

The general method of inspection and construction remains as explained in previous reports, except when the exigency of the case demands; then it is modified to suit the occasion. In the Report of the Chief of Engineers will be found a full description of the plans and methods used in the progress of the work.

Appendix U, 1892, page 1529: Commencement of O'Connor, Laing & Smoot's contract. Construction of South Jetty over old mattress work.

Appendix U, 1893, page 1865: Starting work on North Jetty and transfer of riprap between Fort Point and Bolivar.

Appendix U, 1894, page 1391: Barge line transporting granite between Clinton and jetty.

Appendix T, 1895, page 1801: Dredging on the outer bar.

Appendix S, 1896, pages 1529–1536: Description and operation of U. S. dredge *Comstock.* Plant of the contractors used in construction of jetties. Scour on the outer bar with map showing area of scour and fill, and table of approximate cubic yards removed. Table of subsidence of jetties and recommencement of work on South Jetty.

Appendix T, 1897, pages 1798–1803: Tables showing average cost per linear foot between stations, and subsidence of jetties.

DREDGING.

Dredging was continued during the year, working the first three and one-third months with a double crew, then seven and one-third months with a single crew. The dredge becoming unseaworthy was put on the marine ways for repairs and a general overhauling and renewal of worn-out machinery. The dredge was launched from the ways on the 23d of June, 1898. The repairs are still in progress, and it is expected that she will be ready for work by the first week in August, 1898.

The total amount of material removed during the year was 562,976 cubic yards, of which 146,462 cubic yards was sand taken from the outer bar; 363,112 cubic yards of mixed material, mud, clay, sand, and shell from the bar channel, and 53,402 cubic yards of mixed material, soft mud, sand, and shell from the inner bar.

The average cost per cubic yard dredged was 4.93 cents for operating expenses and 2.87 cents for extraordinary repairs, making the total cost per cubic yard 7.80 cents.

Details of work done, distribution of time, and cost of dredging are herewith forwarded in tabulated form:

Résumé of work done by U. S. dredge Gen. C. B. Comstock, during the fiscal year ending June 30, 1898.

	Hours.	Min.
Effective working time	2,511	50
Delays for bad weather	593	3
Delays for repairs	799	18
Delays for other causes	593	10
Idle on account of Sundays and holidays	839	......
Total time made	5,336	21

Distribution of working time.

	Hours.	Min.	Per cent.
Anchorage to cut	144	14	6
Pumping	1,727	39	69
Cut to dump	195	25	7
Dumping	93	53	4
Dump to cut	163	9	7
Dump to anchorage	154	18	6
Time lost turning	33	12	1
Total	2,511	50	100

Number of loads dredged		1,014.00
Average output per hour dredging	cubic yards	325.89
Average amount dredged per minute in sand	do	4.79
Average amount dredged per minute in mixed material, bar channel	do	5.77
Average amount dredged per minute in mixed material, inner bar	do	5.21

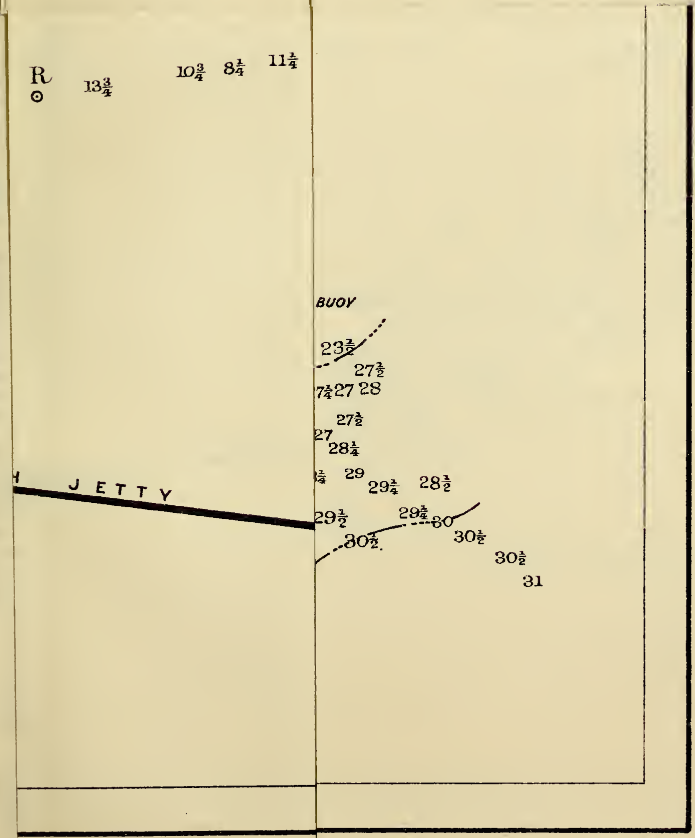
Cost of dredging.

	Total amount expended.	Cost per cubic yard.
Wages	$15,982.12	$0.0283
Subsistence	3,802.04	.0067
Fuel	3,074.38	.0054
Oils, waste, etc	530.86	.0009
Miscellaneous supplies and new outfit	2,705.91	.0048
Ordinary maintenance	1,397.07	.0025
Contingent expenses	436.95	.0007
Operating cost	27,929.33	.0493
Extraordinary repairs	16,178.18	.0287
Total	44,107.51	.0780

SURVEYS.

Surveys have been more or less suspended owing to the urgency of work on fortifications, the office and field force, together with the survey boat *Anna*, being engaged on works of national defense (war).

Monthly surveys of the outer bar, with an occasional one of the inner, were continued, weather permitting, to February, 1898, when they were suspended to June, 1898. The surveys show that 26 feet of water was obtained in October, 1897, and maintained to February, 1898.


R
13¾
10¾
8¼
11¼
BUOY
23½
27½
7¼
27
28
27½
27
28¼
29
29¾
28½
JETTY
29½
29¾
30
30½
30½
30½
31

Eng 55 3

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Idle on account of Sundays and holidays	839	......
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Time lost turning	33	12	1
Total	2,511	50	100

Number of loads dredged		1,014.00
Average output per hour dredging	cubic yards..	325.89
Average amount dredged per minute in sand	do....	4.79
Average amount dredged per minute in mixed material, bar channel	do....	5.77
Average amount dredged per minute in mixed material, inner bar	do....	5.21

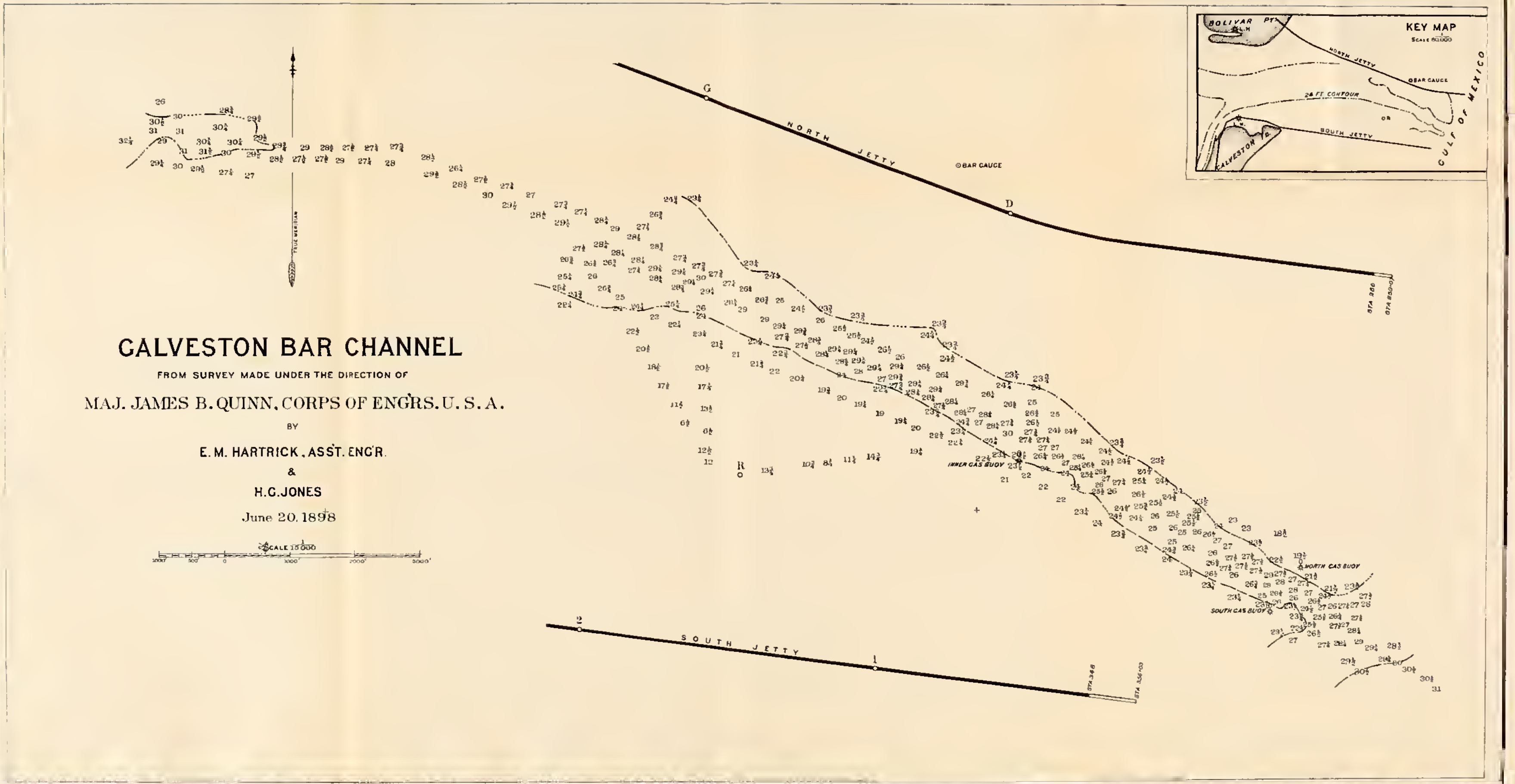
Cost of dredging.

	Total amount expended.	Cost per cubic yard.
Wages	$15,982.12	$0.0283
Subsistence	3,802.04	.0067
Fuel	3,074.38	.0054
Oils, waste, etc	530.86	.0009
Miscellaneous supplies and new outfit	2,705.91	.0048
Ordinary maintenance	1,397.07	.0025
Contingent expenses	436.95	.0007
Operating cost	27,929.33	.0493
Extraordinary repairs	16,178.18	.0287
Total	44,107.51	.0780

SURVEYS.

Surveys have been more or less suspended owing to the urgency of work on fortifications, the office and field force, together with the survey boat *Anna*, being engaged on works of national defense (war).

Monthly surveys of the outer bar, with an occasional one of the inner, were continued, weather permitting, to February, 1898, when they were suspended to June, 1898. The surveys show that 26 feet of water was obtained in October, 1897, and maintained to February, 1898.



GALVESTON BAR CHANNEL

FROM SURVEY MADE UNDER THE DIRECTION OF

MAJ. JAMES B. QUINN, CORPS OF ENGRS. U. S. A.

BY

E. M. HARTRICK, ASST. ENGR.

&

H. G. JONES

June 20, 1898

The annual survey for this report, which has been limited to the outer bar channel, shows a good navigable depth of 25½ feet on June 20, 1898. The U. S. dredge *Gen. C. B. Comstock* has not been at work in this channel since May 19, 1898. The gain in depth on the outer bar channel during the year has not been marked, but the width has been considerably increased.

A resurvey of Galveston Bay has been commenced, a base line measured, and part of the topography adjacent to Galveston plotted. In the month of September, 1897, the sites of the Coast and Geodetic Survey stations were visited. Many of the station marks and reference points placed in 1849–50 were located near the shore of the bay, and it was found on inspection that the banks had caved and washed away in some places 300 feet, leaving the site in the water. As no two stations could be found from which to start a base for triangulation, a new triangulation plan was devised and a new base measured. A detailed report of the base measurement by Mr. L. C. Sabin, assistant engineer, has been left with me for transmittal by Col. C. S. Riché, first lieutenant, Corps of Engineers, U. S. A., and is forwarded herewith.

Very respectfully, your obedient servant,

E. M. Hartrick,
Assistant Engineer.

Maj. James B. Quinn,
Corps of Engineers, U. S. A.

REPORT OF MR. L. C. SABIN, ASSISTANT ENGINEER.

United States Engineer Office,
Galveston, Tex., June 14, 1898.

Sir: I have the honor to submit herewith a partial report upon the measurement of the Galveston Base Line.

The purpose of this base is to serve in the resurvey of Galveston Bay; it is located on the mainland just west of the bay and back of Texas City. It was desired that the base should be so situated that all of the important works about Galveston could be located directly from the base stations; and to accomplish this, it was decided to make the base 10 kilometers in length, although a shorter line would have been quite sufficient for the survey proper.

It having been arranged that this base should be measured with the compound-tape apparatus of the United States Lake Survey, the apparatus was shipped from Sault Ste. Marie January 18, 1898, the writer having left a day or two earlier, in accordance with your letter of December 11, 1897.

On January 24 the line under consideration was looked over, and, the approximate location being selected, a preliminary survey was started January 26. After obtaining lumber and supplies in Galveston, the writer, accompanied by a recorder, returned to Texas City on January 31, and began the organization of a party. Through some delay in transit the apparatus did not arrive until February 21. Meantime such preliminary work as was possible had been done, and immediately on receipt of the apparatus preparations were made to begin measuring. The first measurement was made on March 7 and the last on April 23. On April 30 the apparatus was brought to Galveston, and since that date the time has been occupied in making some of the computations.

The location is a nearly level prairie, the highest point of ground being 13 feet, and the lowest point (excepting the bottom of a narrow creek) 2.5 feet above mean low tide at Galveston. The azimuth of the line is approximately south 191° north. There are no trees or other obstructions on the line, with the exception of one railroad crossing and a few shallow ponds or swamps. A considerable portion of the second, third, and fourth kilometers is low and wet, and there are several small ponds on the tenth. The soil is clayey and becomes very hard in summer, but in the winter is soft, and, in low places, somewhat springy. The method pursued, however, did not render this softness a serious objection, but rather facilitated some of the operations. It is seen that, so far as manipulation is concerned, the line was a very easy one to measure.

By preliminary measurements with the 100-meter tape the base was divided into ten sections, each approximately 1 kilometer in length, and at each kilometer point a permanent monument was built. From the sixth kilometer point the line was run south by double reversals and north by foresight on Dollar Point Beacon, which, in good weather, could be seen from any point on the line.

In order to determine whether the wires changed in length from other causes than changes in temperature, it was decided to measure 1 kilometer three times, once at the beginning, once when about half the base had been measured, and once after all the measurements were completed. On account of its proximity to quarters, the sixth kilometer was selected for this purpose.

MONUMENTS.

At each of the kilometer points a substantial concrete monument was built, those at the north and south base being larger than the others. The bottom of a base-station monument is about 2.4 meters below the surface of the ground. The base of the monument is about 1.8 meters square and 0.6 meter thick, and this is surmounted by a pier about 0.6 meter square and 1.2 meters high. In the center of the top of each pier is embedded a brass 6.35 centimeters long, 3.8 centimeters in diameter at the base, and 1.9 centimeters diameter at the top. In the center of the top a small conical hole is drilled and reamed to fit the steel cone of the hemisphere used with the Repsold cut-off apparatus. The brass is covered by a tightly-fitting cap. The Repsold cut-off was not used in the present measurements, but it was considered that this made a good form of end mark, and that this apparatus might sometime be used on the base.

The intermediate kilometer points are marked by smaller piers, each having a base 0.75 meter square and about 0.3 meter thick, the pier being 0.3 meter square and 0.6 meter high. In the center of each pier is embedded a brass bolt 1.25 centimeters in diameter and 10 centimeters long, with a polished top, on which is cut a cross indicating the fiducial mark. The top of the bolts extend from 1 to 2 centimeters above the top of the concrete piers. When the operations at a given kilometer point were completed a surface monument was planted and centered, the top of this monument being only 10 to 40 centimeters below the surface of the ground. These surface monuments are of cast iron, about 45 centimeters high and 12 centimeters in diameter, hollow, and fitted with a cap having a hole 0.5 centimeter in diameter in the center.

The holes for the concrete monuments were made large enough to receive two posts 20 centimeters by 30 centimeters in cross section, to be set in line, 1.8 meters center to center, one on either side of the monument. These posts were braced together diagonally and were very solid, their purpose being to carry the scale plates, as will be seen later. After the concrete had been set the holes were nearly filled with well-tamped earth, the top of the monument in the center of the hole being left uncovered and a free space being left around the posts about 15 centimeters below the surface of the ground to prevent jars being communicated to the posts.

THE APPARATUS.

The compound-wire base apparatus of the United States Lake Survey was briefly described by Assistant Engineer E. E. Haskell in his account of the remeasurement of the Mackinaw base in 1896, and published in the Annual Report of the Chief of Engineers for 1897. Several improvements have been introduced since that time, and the method of manipulation was therefore somewhat different on the Galveston base.

THE MEASURING WIRES.

The wires are about 1.6 millimeters in diameter and something over 1 kilometer in length. They are divided into 100-meter spaces by means of small brass beads, each having a fine groove about the circumference, near the center. These beads are about 1 centimeter in length and 3 millimeters in diameter, and have a hole extending through them, so that they may be slid on the wire at the end and soldered firmly in place. The end beads are the only ones used in measuring the base, the intermediate beads being provided in order that the wires may be standardized on the 100-meter comparator at Sault Ste. Marie. Six wires were used on this base line, two (Nos. 1 and 3) of piano steel, three (Nos. 2, 4, and 6) of phosphor bronze, and one (No. 5) of tempered spring steel. The wires, when not in use, were wound on boxed reels about 0.66 meter in diameter.

THE WIRE SUPPORTS.

In order that the tension may be transmitted unchanged throughout such a long wire, it is necessary to take extraordinary precautions to reduce friction in the supports. This was done by the use of supporting wires 2 meters in length, with a loop at the upper end and a hook at the lower end. These wires were 0.635 millimeter in diameter. A kilometer being staked out into 10-meter lengths, 5 by 10 centimeter posts were driven with the centers 20 centimeters west of the line. The grade line, which had previously been established, was then marked on the posts with six-penny nails. The support wires already described were looped over screw hooks set 2 centimeters, center to center, in a piece of board about 2 centimeters thick, 7 centimeters wide, and 35 centimeters long. By means of plumb bob and spirit level this board was so nailed on the post that the supporting wire for No. 3 measuring wire was directly over the small peg in the ground marking the 10-meter interval, and the hooks to receive the measuring wires were all at grade.

THE SCALES.

The scales used to read the positions of the beads at the forward end are of tempered spring steel made by the Starrett Company. They are graduated to fifths of millimeters and are read to tenths of millimeters. The scales are numbered from 1 to 6, the first three numbers being 25 centimeters long and the other three 50 centimeters long.

THE SCALE PLATES.

There are two scale plates, one for the forward end and one for the rear end of the kilometer being measured. They are of cast brass with a planed top 28 centimeters by 50 centimeters in size, the longer side being placed parallel to the line. Each plate has a fine graduation line cut across the top of the plate at the center. When in use the rear beads were held even with graduation on the rear plate, while the scales were clamped on the forward plate with some even centimeter mark on the graduation, the scales being set to read from south to north. To secure the plate for use it was first fastened to a plank 7 centimeters thick, 30 centimeters wide, and 2.25 meters long, by means of four carriage bolts. A transit was set up opposite the monument in a line at right angles to the base line, passing through the kilometer point. The 20-centimeter by 30-centimeter posts having been cut to the proper grade, the plank was then placed on them and so adjusted that the graduation line on the plate was nearly over the brass monument and at right angles to the base line, after which it was securely fastened to the posts. With the transit in position a series of readings was taken to obtain the relative positions of the mark on the plate and the cross on the brass monument.

THE REAR CLAMP.

At the rear end the wires are held in a clamp made to hold 12 wires, and so arranged that any wire, independent of the others, may be drawn back or paid out by a screw. The observer at this end may thus keep the rear bead graduations exactly over the graduation on the rear scale plate.

THE TENSION.

The tension is applied by a weight attached to a wire that passes over a tension wheel and is clamped to the measuring wire. This is the automatic method of applying the tension, which was referred to by Assistant Engineer Haskell in his report already mentioned, and was developed by Mr. Haskell after the measurement of the Mackinaw base line. This tension wheel is a bicycle wheel about 70 centimeters in diameter, provided with ball bearings and having a brass rim with a semicircular groove in its circumference about 1 millimeter deep. The friction of these wheels is extremely small, a very few grams being sufficient to turn them. The weights are of steel and weigh approximately 11.4 kilograms. An auxiliary wire is attached to the weight, passes over the tension wheel, and is clamped to the end of the measuring wire about 3 meters ahead of the forward plate. The weights and wheels are numbered the same as the wires, so that weight No. 1 is always attached to wire No. 1, weight No. 2 to wire No. 2, and so on. A set of supporting hooks is placed just ahead of the plate to take the weight of the wire and clamps and prevent friction on the plate from this cause. The tension wheels are held in a suitable frame placed at such an elevation as to bring the top of the wheel level with the scale plate. The wheels are spaced 2 centimeters, center to center, and arranged tandem.

MERCURIAL THERMOMETERS.

The use of two wires having different coefficients of expansion forms a metallic thermometer and, if the wires are of the same temperature at any given instant and do not change in length from other causes than changes in temperature, this renders the observation of mercurial thermometers unnecessary; yet enough thermometers were read to give an approximate idea of the air temperature. These thermometers were made by H. J. Green, of New York, and are known as United States Lake Survey numbers 8977, 8979, 9006, 9007, and 9008. The graduations are cut in the stem and there are no frames. The scales are divided into fifths of degrees centigrade, and they were read to tenths of degrees. A thermometer was placed at each of the following points, 100, 300, 500, 700, and 900 meters from either end. The method of support was by a bracket attached to the supporting wire post at the 100-meter point. The thermometer hung about a foot from the post on the south side, the bulb being at the level of the measuring wires.

PREPARING THE LINE.

The method pursued in preparing the line for measurement was as follows: Pegs 5 centimeters square were driven at intervals of 100 meters and centered. The hundred-meter tape was divided into intervals of 10 meters by means of beads similar to those used on the measuring wires. While the tape was stretched to locate the hundred-meter pegs, smaller pegs about 2.5 centimeters square were driven in line at 10-meter intervals. At the kilometer point a peg was driven and witnessed. Detail levels were then taken over the kilometer to obtain an accurate profile of the ground. This profile when platted served to fix the wire grade and determine the lengths of the posts required for the supporting hooks. The next step was to excavate at the kilometer points, build the concrete monuments in place, and set the large posts to support the scale plates. The 5 by 10 centimeter posts were then driven 20 centimeters west of the line and opposite the small pegs at 10-meter intervals, and the wire grade being marked on the posts the brackets carrying the supporting wires were put in place as described elsewhere. The next step was to saw to grade the large posts at the kilometer points and put the scale plates in place, when it only remained to place the rear clamps, the tension wheel supports, the canvas shelters at the kilometer points, and the flags for signaling.

METHOD OF MEASURING.

The reels being taken to the rear or south end of the kilometer, the first attendant started out with the ends of wires 3, 4, and 5. When 200 meters were out, the second attendant placed a wooden clamp on the wires just back of the 200-meter beads and proceeded with the wires, so that the first attendant dragged only the first 200 meters; when 400 meters were out, the third attendant put a clamp back of the 400-meter beads, and so on until the fifth attendant placed his clamp and proceeded for the last 200 meters. This prevented an undue strain coming on the wires, and brought each attendant to the forward end of his beat.

Each attendant then placed the wires in their proper supporting hooks over his beat of 200 meters and returned to the rear end to repeat the process for the other three wires. As soon as all the wires were in the supporting hooks, the rear observer meantime having fastened the wires in the rear clamp and signaled by flag that he was ready, the tension was put on at the forward end. To accomplish this the No. 5 weight was raised from the ground and a spring balance was hooked into No. 5 wire, the one nearest the posts from which the supporting wires hung. A strain of about 11 kilograms was placed on the wire and the clamp attached to No. 5 weight was fastened to the measuring wire in front of the spring balance. The tension on the latter was then released, the balance detached, and the weight allowed to hang free. This process having been repeated for the other wires, a flag at the forward end was hoisted for a moment as a signal to the attendants to begin plumbing the supporting wires. Each attendant had 200 meters, or 20 sets of supporting wires, to attend to, his thermometer station being at the middle of his beat. The attendants first went over their respective beats once, plumbing the supporting wires approximately by eye. Each then took a weight of about a kilogram with a hook attached, and hanging it on the inner supporting wire of a set, raised the measuring wire to let the supporting wire hang free and come to rest in a perpendicular position. The measuring wire was then returned to place and the other supporting wires of the set brought into the same vertical plane as the first or inner one by means of the eye. Each attendant went over his beat in this way four times. When completed the "all right" sign was passed from the rear and forward until No. 1 attendant notified the forward observer that all supporting wires were plumb. From 2½ to 3½ hours had now been consumed since the party arrived on the ground. Meantime the forward observer had clamped the scales to the forward scale plate with some even centimeter mark on the graduation line, and was ready to begin observations. The flag at the forward end was then hoisted, to signify that observations were to begin, the attendants began reading temperatures at the next even minute and continued reading at intervals of one minute until the head flag was lowered. The scale readings at the forward end were taken at intervals of one-half minute, reading across the scale plate from east to west, or away from the observer, who sat on the east side. About two to two and one-half seconds were required to read the position of each bead, the readings being made and recorded as rapidly as possible. No. 6 wire was nearest the observer, No. 1 next, then in regular order to No. 5, nearest the west edge of the plate. After reading twenty minutes, or earlier if the wires had changed in length enough to throw the supporting wires greatly out of plumb, observations were discontinued, and the forward flag was waved and then lowered as a signal for all attendants to replumb the supporting wires. This time each attendant went over his beat twice, going south toward the rear, then north to the forward end of his beat, then south again to his thermometer station. From fifteen to twenty minutes were required for this replumbing. The word was then passed from the rear forward to the head observer that the supporting wires were plumb, the head flag was hoisted, and observations were resumed.

Each attendant was provided with a timepiece, though usually a poor one, and several times during the day the head observer compared these timepieces with the watch used at the forward end. No great effort was made to have the watches all show the same time, since the scale readings were so nearly continuous that this seemed to be of little importance, but the comparisons of time show closely the actual time at which each temperature was taken, except in a few cases, where the rate of one of the timepieces was so great as to render this somewhat doubtful.

After having obtained from 150 to 250 readings, passing, if possible, through a maximum temperature, so that part of the observations should be taken while the temperature was rising and part while falling, the tension was relieved and the wires reeled in.

In the later observations the tension was relieved during the lunch hour, about the middle of the day, to see if a change in the length of the wires due to stretching could be detected. It was at first attempted to reel in three wires at a time, but it was found impossible to reel them all at the same rate and they were likely to become twisted together, therefore each wire was reeled in by itself. For this purpose No. 6 wire was first taken out of the supporting hooks and laid on the ground. The first attendant took the end of the wire to prevent it kinking or getting caught, the other attendants adjusted their wooden clamps in front of the beads at their respective thermometer stations, and all moved toward the rear end, pulling the wire behind them and taking care that it did not become kinked as the wire was reeled in. After about 300 meters had been reeled in, the second attendant took the end of the wire, he having dropped it at the bead and gone toward the forward end to meet the first attendant; likewise the third attendant went forward a little later to meet the second, and in turn take the end of the wire. Thus the wire was reeled in without it being subjected to undue strain, the time required being about 15 minutes. As each attendant handed the end of the wire to the next he started for the forward end of his beat, removing the next wire from its supporting hooks as he went. There is little doubt that better results could have been obtained had it been possible to carry on the measurements at night, since the accuracy of the method depends upon the supposition that the steel and phosphor-bronze wires are at the same temperature at every instant. It is quite certain that this is not the case where the temperature is changing at all rapidly. It is not considered practicable or safe, however, to stretch wires of such small cross section and so long as these except in daylight. The next best thing was to select densely cloudy days without much wind, or times of heavy fog. During the early part of the field work this sort of weather was looked for, but it soon became evident that these "dead" days could not be expected. There were one or two foggy mornings, but they cleared by 10 a. m. Partially cloudy days were not at all suitable because of the rapid changes in temperature. It was finally found that the bright days were the only ones that could be counted upon. In this locality there are many days without a cloud in the sky when the temperature range from 10 a. m. to 4 p. m. is quite small, and in the later measurements such days were selected as far as possible as the best that could be obtained. The results on such days usually gave very uniform results, but whether a constant error due to the different effects of radiation on the two metals was introduced can not be stated until all of the results have been reduced.

The several kilometers were numbered from south to north and were measured in the following order: 6, 5, 4, 3, 2, 1, 2, 6, 7, 8, 9, 10, and 6. The north end of the kilometer was always made the forward end where the tension was applied and the scales read. Throughout the measurements Assistant Engineer S. M. Wilcox was the observer at the rear end of the kilometer and the writer read the scales at the forward end. Recorder A. Drouet kept the records of scale readings, time, etc., at the forward end. The five attendants were laborers hired temporarily, and had to be drilled carefully in all of their duties, including the reading and recording of thermometers, as trained assistants were not available. In addition to these a cowboy was employed to keep cattle away from the wires, the forward observer was provided with a saddle horse to go over the line frequently, making time comparisons, etc., and a team driven by one of the attendants took the apparatus to and from the field.

RECORDS.

Table 1 gives a specimen page of the record of scale readings taken April 7 on the 6th kilometer, and will require no explanation. The temperature records were as simple as possible. Table 2 shows the method of keeping the "plumbing up" notes to determine the relative position of the brass monument and the graduation on the scale plate. In this work the readings, with an engineer's transit, were taken on scales clamped on either side of the plate.

COMPUTATIONS.

The method of computing the length from a pair of wires, one steel and one phosphor-bronze, is very simple, and may be developed as follows:

Let $L_o =$ the length of the wires when they are of equal length.

Let $E_s =$ the coefficient of expansion of the steel wire.

Let $E_b =$ the coefficient of expansion of the phosphor-bronze wire.

Let $R = \frac{E_b}{E_s}$

Let N_s and $N_b =$ the scale reading of the steel and posphor-bronze wires, respectively.

When the steel wire expands X, giving a length $L_o + X$, the phosphor-bronze wire expands RX, giving a length $L_o + RX$. Then the difference in scale readings $D = N_b - N_s = RX - X = (R-1)X$; whence we can find $X = \frac{D}{R-I}$ and $L_o - X$ becomes known. Then $L_o + X - N_s =$ the distance from the point where the rear beads are held to the point where the zero of the scales is placed.

TABLE NO. 1.—*Galveston base line, sixth kilometer.*

[Scale readings at north or forward end, April 7, 1898.]

Time.	No of obs.	Scale readings on wires No—						Remarks.
		6	1	2	3	4	5	
		cm.	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	
10.42 a. m	1	35.75	10.94	35.10	7.54	36.10	12.48	Wind E., stiff.
10.42½ a. m	2	35.86	11.01	35.19	7.61	36.14	12.52	Sunshine.
10.43 a. m	3	35.94	11.03	35.24	7.67	36.26	12.64	
10.43½ a. m	4	36.03	11.08	.27	.68	.27	.62	
10.44 a. m	5	35.90	11.02	.19	.60	.18	.54	
10.44½ a. m	6	35.96	.07	.28	.65	.27	.62	
10.45 a. m	7	36.12	.18	35.44	7.80	36.42	12.71	
10.45½ a. m	8	36.14	11.18	35.38	7.74	36.37	12.64	Hazy on horizon.
10.46 a. m	9	36.03	11.10	.30	.65	.23	.57	
10.46½ a. m	10	35.92	11.02	35.24	7.61	36.21	12.56	

Position of scales.

Wire No.	Scale No.	Mark on center-line plate.
6	4	25 cm.
1	1	0
2	5	25 cm.
3	2	0
4	6	25 cm.
5	3	0

TABLE No. 2.—*Position of plate referred to monument at second kilometer point.*

[March 27, 1898.]

Time.	Telescope dir. or rev.	No. of readings.	Position of center line of plate.		Observer.	Recorder.	Remarks.
			West end.	East end.			
			mm.	*mm.*			
11.38 a. m	D.	1	S. 0.50	S. 0.70	Sabin	Wilcox	Sunshine.
	D.	2	S. 0.45	S. 0.60	do	do	Wind SE.
	D.	3	S. 0.70	S. 0.85	do	do	Instrument not sheltered.
	D.	4	S. 0.65	S. 0.85	do	do	
	D.	5	S. 0.65	S. 0.85	do	do	
11.48 a. m	R.	1	S. 0.40	S. 0.60	Wilcox	Sabin	
	R.	2	S. 0.40	S. 0.65	do	do	
	R.	3	S. 0.40	S. 0.65	do	do	
	R.	4	S. 0.35	S. 0.65	do	do	
11.55 a. m	R.	5	S. 0.38	S. 0.65	do	do	

CORRECTION FOR INCLINATION OF SUPPORTING WIRES.

When the measuring wires contract or expand the supporting wires are thrown out of plumb, those at the forward end having the greatest range in movement, and those nearest the rear end the least. This prevents the full effect of the change in temperature being shown in the scale readings; thus, if the wires expand, the supporting wires tend to pull the measuring wire toward the rear end, making the increase in scale readings less than should result from the change in temperature. A series of experiments made on the sixth kilometer made it possible to evaluate this effect. After plumbing the wires a set of readings was taken which we will call *a*. An extra tension or weight was placed on one of the wires, say No. 1, and a series of readings taken which we may call *b*. The supporting wires were then replumbed, and a third set of readings taken, which we may designate as *c*. It will be seen that the difference between *a* and *b* will give the effect of the extra weight minus the effect due to inclination of supporting wires. The difference between *a* and *c* will give the effect of the extra weight alone, and the difference between *b* and *c* will give the effect of the nonperpendicularity of supporting wires alone, all being expressed in terms of scale readings. The effect of the changes in temperature were easily eliminated in these experiments, since the similar wires not having an extra tension applied indicated how much of the change in scale readings was due to a change in temperature. While the results of these experiments showed a considerable range in values, yet the precision of the mean seemed to be quite satisfactory. The result may be stated as follows: A change in scale reading of one centimeter, without replumbing the supporting wires, makes an error in scale reading of 0.07 millimeter ∓ 0.06 for wires 1 and 3, and of 1.66 millimeters ∓ 0.06 for wires 2, 4, and 6.

In applying these corrections to the observed scale readings it was assumed that the mean of the first five readings after replumbing represented the position of the beads during replumbing. This is, of course, only an approximation, though it must be very close to the truth unless the temperature is changing very rapidly.

Table 3 shows a specimen page of the computations for wires 1 and 2 only. The observations were treated in groups of five to facilitate the reductions. The first column gives the time of day, the second the number of observations, the third the group's letter. The fourth and fifth columns give the mean scale readings as observed, the sixth and seventh show the corrections due to inclination of supporting wires, and the eighth and ninth give the corrected mean scale readings. The tenth column shows the difference in scale readings of bronze and steel, the eleventh gives the values of X obtained by dividing D by R-1, and the twelfth column gives the several values for the quantity X-N1, which permits us to determine the degree of precision attained as in columns thirteen and fourteen. Column fifteen shows the temperature changes taking place during the observations of the group, as indicated by the changes in scale readings. The length of the base can not be given at this writing, since the computations are not completed, and the absolute length of the wires are not yet known. A preliminary computation has been made for wires 1 and 2 only, and indicates that the probable error for any given kilometer due to errors of manipulation alone is quite small.

TABLE NO. 3.—*Specimen of computations.*

Time.	Number of observations.	Group.	Scale readings mean observed.		Correction for inclination of supporting wires.	
			No. 1.	No. 2.	No. 1.	No. 2.
1.	2.	3.	4.	5.	6.	7.
10.42 to 10.44 a. m	1–5	a	110.16	101.98	....	....
10.44½ to 10.46½ a. m	6–10	b	111.10	103.28	+.07	+.22
10.47 to 10.49 a. m	11–15	c	110.36	102.30	+.01	+.05
10.49½ to 10.51½ a. m	16–20	d	111.08	103.10	+.06	+.18
10.52 to 10.54 a. m	21–25	e	111.60	103.86	+.10	+.32
10.54½ to 10.56½ a. m	26–30	f	111.50	103.82	+.09	+.30
10.57 to 10.59 a. m	31–35	g	112.22	104.90	+.14	+.48
10.59½ to 11.01½ a. m	36–40	h	112.90	106.04	+.19	+.66

Time.	Corrected scale readings.		$D=N_2-N_1$.	X.	$X-N_1$.	Residuals of mean minus observed.		Temperature changes.
	N_1.	N_2.				v.	vv.	
1.	8.	9.	10.	11.	12.	13.	14.	15.
10.42 to 10.44 a. m	110.16	101.98	—8.18	—15.2	—125.4	+0.1	.01	st.
10.44½ to 10.46½ a. m	111.17	103.45	7.67	14.3	125.4	+0.2	.04	st.
10.47 to 10.49 a. m	110.37	102.35	8.02	14.9	125.3	+0.0	.00	st.
10.49½ to 10.51½ a. m	111.14	103.28	7.86	14.6	125.8	+0 5	.25	st.
10.52 to 10.54 a. m	111.70	104.18	7.52	14.0	125.7	+0.4	.16	st.
10.54½ to 10.56½ a. m	111.59	104.12	7.47	13.9	125.5	+0.2	.04	st.
10.57 to 10.59 a. m	112.36	105.38	6.98	13.0	125.3	+0.1	.01	f. s.
10.59½ to 11.01½ a. m	113.09	106.70	6.39	11.9	125.0	—0.3	.09	r. s.

GRADE CORRECTIONS.

Table 4 gives the necessary data for obtaining the grade corrections and the reduction to sea level. The tide gauge readings from February 1 to April 30 will, in connection with the automatic gauge records at the Government wharf, Galveston, give a good determination of the elevation of B. M. T. C., which is about 9 feet above mean low tide.

It is seen that the wire grade is at the same elevation at the two ends of the line, thus the effect of variations in tension due to the wire being inclined to the horizon in some of the kilometers is equalized, and no error due to this cause appears in the length of the whole base, though the lengths of the kilometers where the wires were so inclined had a small error from this source.

Very respectfully, your obedient servant,

L. C. SABIN,
Assistant Engineer.

First Lieut. C. S. RICHE,
Corps of Engineers, U. S. A.

TABLE NO. 4.—*Elevations at kilometer points.*

Point.	Approximate elevation ground.	Approximate bottom monument.	Top of brass plugs.	Grade wire.
Zero, south base	+ 7.4	—1.0	*a* 5.08	+11.0
No. 1	7.6	+3.0	6.27	11.0
No. 2	4.4	0.0	2.52	8.0
No. 3	3.1	—1.0	2.18	7.0
No. 4	4.4	0.0	(?)	7.0
No. 5	6.9	+2.0	4.96	10.0
No. 6	8.8	+4.0	6.99	13.0
No. 7	10.7	+6.0	8.92	14.0
No. 8	8.9	+4.0	7.20	11.0
No. 9	9.2	+4.5	7.53	11.0
No. 10, north base	7.3	—1.0	*a* 5.06	11.0

a Under cap.

NOTE.—The above elevations referred to mean low tide assuming B. M. T. C. to be 8.95.

REPORT OF MR. F. OPPIKOFER, ASSISTANT ENGINEER.

United States Engineer Office,
Galveston, Tex., June 30, 1898.

Sir: I have the honor to submit the following report regarding progress of the tidal records of Galveston Harbor:

I was placed in charge of these records by Maj. A. M. Miller, Corps of Engineers, in March, 1897. These records have been kept for the purpose of—

1. Establishing the mean low tide at Galveston.
2. Showing the yearly and monthly fluctuation of mean low tide at Government wharf.
3. Showing the retardation of high and low water between bar, gorge, and Government wharf.
4. Showing the relative fluctuation between bar, gorge, and Government wharf.
5. Showing the effect of the jetties on the retardation and fluctuation curves between bay and gulf.

Other duties have interrupted the platting and study of these records, but the following results have been obtained.

Three automatic gauges have been in operation at the Government wharf, gorge, and bar, respectively, and their records have been platted to December 31, 1897. By a monthly application of Mitchell's rule it was shown that Government wharf and gorge gauge maintained the same level of their zeros, while the zero of the bar gauge was lowered by settlement about 0.3 foot.

The annual fluctuation of the mean low tide at Government wharf has been as follows, from data available:

October, 1872, to July, 1873	+0.000
July, 1876, to June, 1877	+ .02
June, 1878, to June, 1879	— .02
January, 1883, to January, 1884	+ .23
May, 1887, to January, 1889	+ .41
January, 1889, to January, 1890	+ .30
January, 1890, to January, 1891	+ .34
January, 1891, to January, 1892	+ .40
July, 1893, to July, 1894	+ .32
July, 1894, to July, 1895	+ .12
June, 1895, to June, 1896	+ .24
June, 1896, to June, 1897	+ .24
Or a mean of	+ .216

The mean low tide at the bar gauge from June, 1895, to June, 1897, was —0.45 foot, and the mean low tide during the same period at the Government wharf +0.24 foot. The mean high tide at the bar gauge from June, 1895, to June, 1897, was found to be +1.85 feet, against +1.1 feet at Government wharf.

This shows the mean low tide at the bar gauge to be 0.69 foot lower than the mean low tide at the Government wharf, and the mean high tide at the bar gauge 0.75 foot higher than the mean high tide at the Government wharf. This difference between gulf and bay is no doubt largely due to the concentration of the channel by the jetties.

Since the completion of the North Jetty the bar gauge has been neglected, as there is no facility for visiting it.

Very respectfully, your obedient servant,

F. Oppikofer,
Assistant Engineer.

Maj. James B. Quinn,
Corps of Engineers.

(Through Mr. E. M. Hartrick, assistant engineer in charge.)

V 2.

IMPROVEMENT OF SHIP CHANNEL IN GALVESTON BAY, TEXAS.

The dredging of a channel through Galveston Bay was undertaken with a view of affording the commerce of the streams emptying into its northern portion an outlet to Galveston and the Gulf of Mexico.

No work was done during the present fiscal year, nor has any been done since operations were suspended September 26, 1895, as the depth of water in the channel was greater than that found in Buffalo Bayou, immediately at and below Houston, and was sufficient for the draft of vessels navigating the bay; also as Congress had indicated a possible intention of again amending the project, so as to provide a channel having a depth of 25 feet instead of 12 feet.

A survey of the bay along the line of the ship channel was made in March, 1897, in compliance with an act approved February 1, 1897, public, No. 38, providing for an examination and survey of a water route from the mouth of the jetties at the city of Galveston, Tex., through the ship channel and up Buffalo Bayou to the city of Houston, Tex.

Upon plotting the survey it was observed that a shoaling of from 2 to 3 feet had occurred at Morgans Cut, and that the channel in the lower bay had practically been obliterated.

On July 26, 1897, a Board met at Houston and reported November 3, 1897. It was their opinion that the interests involved justify the improvement proposed, at a total cost of $4,000,000 and an estimated cost for maintenance of $100,000 annually. (See House Doc. No. 99, Fifty-fifth Congress, second session.)

Total amount expended on this improvement to June 30, 1898	$800,328.16

Money statement.

July 1, 1897, balance unexpended	$48,688.69
July 1, 1898, balance unexpended	48,688.69
Amount (estimated) required for completion of existing project	*169,675.44
Amount that can be profitably expended in fiscal year ending June 30, 1900	*169,675.44
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

Abstract of appropriations made by Congress for improving ship channel in Galveston Bay, Texas.

By act of—		By act of—	
June 10, 1872	$10,000.00	August 2, 1882	$94,500.00
June 23, 1874	10,000.00	August 11, 1888	100,000.00
March 3, 1875	35,200.00	September 19, 1890	132,316.85
August 14, 1876	72,000.00	July 13, 1892	40,000.00
June 18, 1878	75,000.00	August 18, 1894	50,000.00
March 3, 1879	80,000.00	June 3, 1896	50,000.00
June 14, 1880	50,000.00		
March 3, 1881	50,000.00	Total	849,016.85

COMMERCIAL STATISTICS OF SHIP CHANNEL IN GALVESTON BAY, TEXAS, FOR THE FISCAL YEAR ENDING JUNE 30, 1898.

It is not practicable to give the statistics of the commerce of the ship channel. Almost the entire floating commerce of Buffalo Bayou, Trinity River, and Cedar Bayou is carried through this channel, the commercial statistics being given in the reports on those works. The number of vessels passing through Morgans Canal during the year was 1,402, of which 746 were north bound and 656 were south bound.

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* Estimated last year.

V 3.

OPERATING AND CARE OF MORGANS CANAL, TEXAS.

A watchman was stationed at Morgans Point in charge of Morgans Canal. His services were paid from allotment of $360, made by the Department on July 16, 1897, from the permanent indefinite appropriation provided for in section 4, act of July 5, 1884. This amount was expended as follows:

James A. Black, salary, twelve months, at $30	$360

Abstract of allotments made for operating and care of Morgans Canal, Texas, provided for by section 4, act of July 5, 1884.

December 2, 1896	$240
July 16, 1897	360
Total	600

V 4.

IMPROVEMENT OF CHANNEL IN WEST GALVESTON BAY, TEXAS.

This channel is designed to afford inside water connection between the Brazos River and Galveston having a depth of 5 feet. Operations were suspended on October 2, 1895, at which time a channel 100 feet wide and from 3 to 3½ feet deep was available.

No work was done during the present fiscal year because a greater depth of water exists in the bay than is found in the Galveston and Brazos Canal, owned by a private corporation having the right to levy tolls, and through which most vessels plying between Galveston and the Brazos River passed.

Amount expended on this improvement to June 30, 1897	$19,750.97
Amount expended during present fiscal year	25.00
Total amount expended to June 30, 1898	19,775.97

Money statement.

July 1, 1897, balance unexpended	$5,249.03
June 30, 1898, amount expended during fiscal year	25.00
July 1, 1898, balance unexpended	5,224.03
July 1, 1898, balance available	5,224.03
Amount (estimated) required for completion of existing project	*4,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	*4,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

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* Estimated for last year.

Abstract of appropriations made by Congress for improving channel in West Galveston Bay, Texas.

By act of—	
July 13, 1892	$15,000
August 18, 1894	5,000
June 3, 1896	5,000
Total	25,000

COMMERCIAL STATISTICS OF WEST GALVESTON BAY, TEXAS, FOR THE FISCAL YEAR ENDING JUNE 30, 1898.

Vessels using bay, 19 (1 steam and 18 sailing vessels); length, 20 to 100 feet; draft, 2 to 5 feet; tonnage, 3 to 100 tons.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton	3,085	$431,900.00
General merchandise	8,200	394,830.00
Total	11,285	826,730.00

Increase since last year, 185 tons.

Comparative statement for fiscal years 1896 to 1898.

Articles.	1896.	1897.	1898.
Cotton ... tons	1,875	3,000	3,085
General merchandise ... do	4,500	8,100	8,200
Total tonnage	6,375	11,100	11,285
Total value	$442,500	$810,000	$826,730

V 5.

IMPROVEMENT OF TRINITY RIVER, TEXAS.

Work at this locality is confined to the mouth and consists in constructing two jetties at the entrance known as the Middle Pass, the one generally used by vessels, with a view to deepening the water on the bar opposite it to 6 feet.

The west jetty was completed on April 6, 1894, and a channel was dredged across the bar immediately afterwards so as to afford navigation temporary relief.

No work was done during the present fiscal year, nor has there been any since operations were suspended in 1894, the construction of the east jetty having been postponed until sufficient funds were on hand to enable it to be built quickly and economically.

The amount expended during the year was $115, and was used in removing a log jam at the mouth of the river and collecting commercial statistics for the fiscal year 1896.

Amount expended on this improvement to June 30, 1897	$69,329.76
Amount expended during present fiscal year	115.00
Total amount expended to June 30, 1898	69,444.76

Money statement.

July 1, 1897, balance unexpended	$7,670.24
June 30, 1898, amount expended during fiscal year	115.00
July 1, 1898, balance unexpended	7,555.24
July 1, 1898, balance available	7,555.24
Amount (estimated) required for completion of existing project	*15,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	*15,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations made by Congress for improving Trinity River, Texas.

By act of—	
June 18, 1878	$10,000
March 3, 1879	2,500
June 14, 1880	4,000
March 3, 1881	10,000
August 2, 1882	8,000
August 11, 1888	12,500
September 19, 1890	$10,000
July 13, 1892	10,000
August 18, 1894	5,000
June 3, 1896	5,000
Total	77,000

COMMERCIAL STATISTICS OF TRINITY RIVER, TEXAS, FOR FISCAL YEAR ENDING JUNE 30, 1898.

Vessels using the river, 30 (28 sailing vessels, 1 barge, and 1 steamer); length on deck, 30 to 100 feet; draft, 2.5 to 5 feet; tonnage, 4 to 150 tons; trips made during the year, 829; total tonnage, 10,728.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton	79	$7,875.00
Lumber	8,747	26,337.00
Coal	385	1,540.00
Stock	86	708.00
General merchandise	561	20,037.00
Total	9,858	56,497.00

Increase since last year 3,030 tons.

Comparative statement for fiscal year 1896 to 1898.

Articles.		1896.	1897.	1898.
Cotton	tons	27	92	79
Lumber	do	6,955	5,795	8,747
Coal	do	602	718	385
Stock	do	64	37	86
General merchandise	do	73	186	561
Total tonnage		7,721	6,828	9,858
Total value		$37,846	$59,606	$56,497

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*Estimated for last year.

V 6.

IMPROVEMENT OF BUFFALO BAYOU, TEXAS.

The object of this work is to provide the city of Houston, Tex., with a waterway to Galveston and the Gulf of Mexico, having a depth of 12 feet.

Work was suspended on November 4, 1895, at which time there was a depth of 10 feet in the channel, which had also been cleared of obstructions.

No work was done during the present fiscal year, because there was ample depth of water in the bayou at the beginning of the cotton season to satisfy the demands of commerce, and as Congress, by act approved February 1, 1897 (Public, No. 38), had indicated a possible intention of providing a channel 25 feet deep instead of 12 feet in the bayou, and also of establishing a harbor at or near Houston 25 feet deep.

The survey called for by above-mentioned act was made in March, 1897. It developed the fact that but little shoaling had occurred except directly at and for a short time below the city of Houston.

On July 26, 1897, a Board met at Houston and reported November 3, 1897. It was their opinion that the interests involved justify the improvement proposed at a total cost of $4,000,000, and an estimated cost of maintenance of $100,000 annually. (See House Doc. No 99, Fifty-fifth Congress, second session.)

The money expended during the year was applied to collecting the commercial statistics of the commerce using the bayou for this fiscal year and 1896.

Amount expended on this improvement to June 30, 1897	$209, 736. 38
Amount expended during the fiscal year	401. 26
Total amount expended to June 30, 1898	**210, 137. 64**

Money statement.

July 1, 1897, balance unexpended	$19, 013. 62
June 30, 1898, amount expended during fiscal year	401. 26
July 1, 1898, balance unexpended	18, 612. 36
July 1, 1898, balance available	18, 612. 36
Amount (estimated) required for completion of existing project	*156, 549. 75
Amount that can be profitably expended in fiscal year ending June 30, 1900	*100, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

Abstract of appropriations made by Congress for improving Buffalo Bayou, Texas.

Act of—	
March 31, 1881	$25, 000. 00
August 2, 1882	50, 000. 00
July 2, 1884	25, 000. 00
August 5, 1886	18, 750. 00
August 11, 1888	25, 000. 00
September 19, 1890	25, 000. 00
July 13, 1892	$25, 000. 00
August 18, 1894	15, 000. 00
June 3, 1896	20, 000. 00
Total	228, 750. 00

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* Estimated for last year.

COMMERCIAL STATISTICS OF BUFFALO BAYOU, TEXAS, FOR THE FISCAL YEAR ENDING JUNE 30, 1898.

Vessels using bayou, 112 (14 steam vessels, 35 barges, and 63 sailing vessels); length, 20 to 162 feet; draft, 2.5 to 6.5 feet; tonnage, 2.5 to 358 tons; trips made during the year, 3,525; total tonnage, 389,574.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton (514,024 bales)	128, 506	$15, 563, 065. 00
Cotton products	12, 595	434, 610. 00
Coal	4, 758	23, 790. 00
Lumber	4, 440	5, 431. 00
Building material	7, 028	13, 084. 00
General merchandise	3, 141	203, 816. 00
Total	160, 468	16, 243, 796. 00

Increase since last year, 31,414 tons.

Comparative statement for the fiscal years 1896 to 1898.

Articles.		1896.	1897.	1898.
Cotton	tons	78, 686	82, 767	128, 506
Cotton products	do	16, 672	22, 823	12, 595
Coal	do	1, 660	1, 948	4, 758
Lumber	do	3, 185	2, 569	4, 440
Building material	do	5, 485	10, 158	7, 028
General merchandise	do	9, 191	8, 789	3, 141
Total tonnage		114, 879	129, 054	160, 468
Total value		$14, 567, 372	$13, 584, 293	$16, 243, 796

V 7.

IMPROVEMENT OF BRAZOS RIVER, TEXAS.

Under the present project the improvement of this stream is confined to the removal of snags and other obstructions from the bed and banks between Velasco and Richmond, a distance of 89 miles.

It is expected that the work, when completed, will put that portion of the river in a good navigable condition at ordinary stages of water, but the improvement will not be permanent unless the obstructions brought down on each rise in the river are removed annually.

No work was done during the fiscal year, owing to the unfavorable stage of water in the river, nor has any of the appropriation been expended.

Money expended during the year was applied to collecting the commercial statistics of the commerce using the bayou for the fiscal year 1896.

Money statement.

July 1, 1897, balance unexpended	$5, 000. 00
June 30, 1898, amount expended during fiscal year	20. 00
July 1, 1898, balance unexpended	4, 980. 00
Amount (estimated) required for completion of existing project	5, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	5, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

COMMERCIAL STATISTICS OF BRAZOS RIVER, TEXAS, BETWEEN VELASCO AND RICHMOND, FOR FISCAL YEAR ENDING JUNE 30, 1898.

Vessels using river, 35 (6 steam and 29 sailing vessels); length, 15 to 100 feet; draft, 2½ to 9 feet; tonnage, 6 to 47 tons.

Amount and value of freight transported.

Articles.	Tons.	Approximate value.
Cotton	3,785	$600,400.00
Cotton seed	8,000	48,000.00
Cattle	2,200	66,000.00
Lumber	500	4,500.00
General merchandise	950	80,750.00
Total	15,435	799,650.00

Increase since last year, 735 tons.

Comparative statement for fiscal years 1897 and 1898.

Articles.		1897.	1898.
Cotton	tons	3,750	3,785
Cotton seed	do	7,500	8,000
Cattle	do	2,000	2,200
Lumber	do	450	500
General merchandise	do	1,000	950
Total tonnage		14,700	15,435
Total value		$794,000	$799,650

V 8.

ESTIMATES OF COST OF OPENING A CHANNEL 6 FEET IN DEPTH THROUGH THE BAR AT THE MOUTH OF DOUBLE BAYOU, ON THE EAST SIDE OF GALVESTON BAY, TEXAS.

[Printed in House Doc. No. 387, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 25, 1898.

SIR: Joint resolution of Congress, approved March 5, 1898, authorizes and directs the Secretary of War—

> to submit estimates of the cost of opening a channel through the bar at the mouth of Double Bayou, on the east side of Galveston Bay, in the county of Chambers and State of Texas, such channel to be six feet deep and one hundred feet wide, beginning at a point in Trinity or Galveston Bay, where the depth shoals to six feet, and creating a channel of this depth to a point of six feet depth in Double Bayou, the entire distance not to exceed one thousand two hundred yards, all as shown by maps and surveys made in compliance with the provisions of the river and harbor act of August seventeenth, eighteen hundred and ninety-four, and submitted to Congress under date of November twenty-ninth, eighteen hundred and ninety-five; and in making the foregoing estimate the cost shall be estimated for a channel created by permanent walls, also by the process of dredging alone.

It may be proper to remark that the river and harbor act of August 17, 1894, does not provide for a survey of this locality, but a survey of the mouth of this bayou was made in accordance with provisions of the river and harbor act of September 19, 1890, and that is supposed to be the act to which reference was intended in the above joint resolution.

The duty contemplated by the resolution was assigned to Lieut. C. S. Riché, Corps of Engineers, and a copy of his report, dated March 16, 1898, with map, upon the subject is respectfully submitted herewith.

The most recent survey of the bar at the mouth of Double Bayou shows that the distance from a depth of 6 feet in Galveston Bay to a depth of 6 feet in Double Bayou is nearly 2,200 yards, and the estimates submitted are intended to cover the cost of improvement throughout such distance.

The cost of obtaining the required depth, as outlined in the report, is estimated at $20,000, which does not include the cost of maintenance. To protect the clay embankment from wave action $7,000 additional would be necessary; but it is thought that it would be more satisfactory to redredge the channel when it should begin to shoal, and that the deposits on the bank from this second dredging would make it more nearly stable.

The construction of permanent walls, such as are mentioned in the resolution, would necessitate the use of riprap; and even then some dredging would also be required, as it is unlikely that the scour from Double Bayou would produce the desired depth unaided. The cost of the work, if done according to this latter method, is estimated at $80,000.

Lieutenant Riché states that with a Government dredge available, of the character proposed for the Houston ship channel by the Board of Engineers in their report contained in House Doc. No. 99, Fifty-fifth Congress, second session, the dredging at Double Bayou could be done in about ten days, at a cost of not over $4,000, and that the cost of maintenance by redredging would be small.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

REPORT OF FIRST LIEUT. C. S. RICHÉ, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., March 16, 1898.

GENERAL: In compliance with your letter of March 12, 1898, and public resolution No. 13, inclosed therewith, I have the honor to report the following:

The most recent survey of the bar at the mouth of Double Bayou shows that the distance from a depth of 6 feet in Galveston Bay to a depth of 6 feet in Double Bayou considerably exceeds 1,200 yards, and is nearly 2,200 yards. It is impossible, therefore, to comply literally with the wording of the resolution in submitting estimates. I judge, however, that the resolution contemplates a continuous depth of 6 feet from the bay to the bayou, and estimates have been made accordingly.

At present the Government has no dredging plant at this locality suitable for the work referred to, and it would not pay to construct a dredging plant for this work alone, as, with the limited amount of dredging at Double Bayou, it would be cheaper to do the work by contract. It is thought that with the private dredging plants in this vicinity the work can be done at a contract price of not over 25 cents per cubic yard.

The material to be excavated is a sticky clay, and if deposited about 100 feet from the edge of the cut in such manner as to form a continuous bank about 3 feet above water it will probably remain in place for a long time, especially if it be given a gentle slope on the side away from the cut. Redredging will, of course, be necessary from time to time to maintain the channel.

The estimate for the work, if done as above outlined, is as follows:

72,000 cubic yards of excavation, at 25 cents	$18,000
Superintendence, contingencies, etc	2,000
Total	20,000

To protect the clay embankment from wave action an additional amount of $7,000 would be necessary, but it is thought that it would be more satisfactory to redredge the channel as soon as it began to shoal, and that the material deposited on the bank from this second dredging would make the bank more nearly stable.

To construct permanent walls it would become necessary to use rip rap. With the smallest possible cross section for these walls abou- 20,500 cubic yards of riprap would be required, and this would cost, it place, about $3 per cubic yard. Some dredging would be necessary also, as it is unlikely that the scour from Double Bayou would be capable of producing the desired depth unaided.

The estimate for the work, if done in this latter manner, is as follows:

20,500 cubic yards sandstone riprap, in place, at $3	$61,500
Dredging	10,000
Superintendence, contingencies, etc	8,500
Total	80,000

With a Government dredge available, of the character proposed for the Houston ship channel by the Board of Engineers in their report (House Doc. No. 99, Fifty-fifth Congress, second session), the dredging at Double Bayou could be done in about ten days, at a cost of not over $4,000, and the cost of redredging for maintenance would be small.

A map of the locality is submitted herewith, showing the proposed channel and its permanent walls in red.

Attention is also invited to the report of Assistant Engineer E. M. Hartrick, herewith.

Very respectfully, your obedient servant,

C. S. Riché,
First Lieut., Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

REPORT OF MR. E. M. HARTRICK, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., March 15, 1898.

SIR: I have the honor to report in compliance with "joint resolution providing for an estimate of cost of certain improvements at the mouth of Double Bayou, in Galveston Bay, Texas."

To dredge a channel 6 feet deep and 100 feet wide will require the removal of 72,000 cubic yards of material, said material to be deposited 100 feet from edge of cut and to form a continuous bank about 3 feet above water. At 25 cents per cubic yard it will cost $18,000.

To protect the outer slope of above bank from wave action will cost $7,000, but this, I think, will not be necessary, as the material is, in general, sticky clay, and after the second dredging will be more or less permanent.

To construct permanent walls of riprap it will take, with the smallest possible cross section, 20,500 cubic yards of sandstone riprap. At $3 per cubic yard, placed, it will cost $61,500.

To this will have to be added some dredging, as it is most unlikely that the walls will be able to create current enough to scour out to the required depth. Add one-half of above estimate for dredging to the cost of jetties.

The estimated cost of permanent improvement, including dredging, will be $75,000.

To the above will have to be added contingencies, office expenses, and superintendence.

The character of the material was found by forcing a sounding rod and 1¼-inch gas pipe into the bottom; 26 borings were recorded, with intermediate ones of a similar character of which no record was kept. The record shows in general a crust of sand from 3 to 6 inches thick, then 1 to 4 feet of soft mud, and then sticky clay. No actual hard clay was encountered, and all material can be removed with a suction dredge.

Inclosed will be found map with proposed channel and permanent walls marked thereon in red.

Very respectfully, your obedient servant,

E. M. HARTRICK,
Assistant Engineer.

First Lieut. C. S. RICHÉ,
Corps of Engineers, U. S. A.

V 9.

EXAMINATION AND SURVEY FOR A CHANNEL FROM THE MOUTH OF THE JETTIES AT GALVESTON, TEX., THROUGH THE EXISTING SHIP CHANNEL AND UP BUFFALO BAYOU TO HOUSTON, AND FOR A HARBOR AT OR NEAR HOUSTON.

[Printed in House Doc. No. 99, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1897.

SIR: By the provisions of the act of Congress approved February 1, 1897, the Secretary of War was authorized and directed to make an examination and survey, with an estimate of the necessary cost, for a water channel not less than 25 feet deep and 100 feet wide, extending from the mouth of the jetties at the city of Galveston, Tex., through the existing ship channel and up Buffalo Bayou to the city of Houston, Tex., and for a harbor at or near Houston of a depth of not less than 25 feet and of a width of 500 feet, and to make a report of such examination, survey, and estimate, with its commercial importance, to Congress.

By authority of the Secretary of War a board of three officers of the Corps of Engineers was constituted to make the examination and report called for in the act of Congress, and I have the honor to submit the accompanying copy of report of November 3, 1897, with map,* by this Board.

The Board is of opinion that in the first division of this water route (through Galveston Bay, including the Morgan Canal) the width of channel should be 150 feet, with slopes such as the material may assume, varying from 1 on 2 to 1 on 4, and that to do this dredging economically and within reasonable time the construction of two large suction dredges is deemed necessary, their estimated cost being $100,000 each. For the second division (from north end of Morgan Canal to Harrisburg) the Board recommends a width of channel limited to 100 feet. In the third division (between Harrisburg and Houston) the removal of at least one bend by a cut-off will be required, and the straightening and widening of others is proposed. It is also proposed to remove the point just below the San Antonio and Aransas Pass Bridge and to widen the channel at the mouth of White Oak Bayou in Houston.

The cost of this work is estimated by the Board as follows:

First division, including construction of two suction dredges	$1,100,000
Second division	900,000
Third division	1,700,000
Administration and contingencies	300,000
Making a total of	4,000,000

The estimated cost of maintenance is $100,000 annually.

It is the opinion of the Board that the interests involved justify the improvement proposed.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. R. A. ALGER,
Secretary of War.

REPORT OF BOARD OF ENGINEERS.

NEW YORK, *November 3, 1897.*

GENERAL: The Board convened by Special Orders No. 7, headquarters, Corps of Engineers, February 12, 1897, met at Houston, Tex., July 26, 1897.

The duties of the Board are set forth in the following act of Congress:

AN ACT to provide for an examination and survey of a water route from the mouth of the jetties at the city of Galveston, Texas, through the ship channel and up Buffalo Bayou to the city of Houston, Texas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he hereby is, authorized and directed to make an examination and survey, with an estimate of the necessary cost, for a water channel not less than twenty-five feet deep and one hundred feet wide, extending from the mouth of the jetties at the city of Galveston, Texas, through the existing ship channel and up Buffalo Bayou to the city of Houston, Texas, and for a harbor at or near Houston of a depth of not less than twenty-five feet and of a width of five hundred feet, and to make a report of such examination, survey, and estimate, with its commercial importance, to Congress.

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*Not reprinted. Printed in House Doc. No. 99, Fifty-fifth Congress, second session.

SEC. 2. That the cost of said examination, survey, and estimate be paid out of funds already appropriated for work on the improvement of the ship channel and Buffalo Bayou.

Approved, February 1, 1897.

The survey was made in April, 1897, and on July 28 the Board made a personal examination of the water route between Houston and the Galveston jetties.

This water route, 58¾ miles long, is naturally divided into two distinct parts: First, the portion from the jetties to the Morgan Canal; and second, the part between the Morgan Canal and the city of Houston.

The first section is through the open waters of Galveston Bay and the Morgan Canal, and is 25½ miles in length.

The second section passes through the San Jacinto Bay and the river of the same name to Lynchburg, a distance of 8¾ miles, and thence up Buffalo Bayou to Houston, a distance of 24½ miles.

A sketch[1] showing the route is submitted herewith.

Buffalo Bayou is a tidal arm of Galveston Bay, depending for its water level on the rise and fall of the tide in the bay. From Houston to Harrisburg, a distance of 11 miles, the bayou is narrow and tortuous, with a width rarely exceeding 100 feet and a low-water available depth of about 8 feet; the upper portion, within the limits of the city of Houston, is the receptacle for the sewage and surface drainage of the city, and is constantly shoaling from this cause.

There are several bends between Houston and Harrisburg, around which seagoing vessels of a length of 350 feet could not safely be navigated; in some reaches the timber growing to the water's edge is an obstruction to navigation.

From Harrisburg to Lynchburg, where the bayou joins the San Jacinto River, a distance of 16 miles, the bayou becomes wider and deeper, the curves are more gentle and afford no serious obstruction to navigation. The depth of the water in this portion varies from 12 to 20 feet. From Lynchburg the San Jacinto River and Bay are easily navigable to the north end of Morgan Canal, for a depth of 12 feet; there are no abrupt or difficult bends.

The remainder of the water route, from the north end of Morgan Canal to Bolivar Channel, a distance of 25½ miles, is a channel dredged to a depth of 9 feet through silt, clay, sand, and shell, the natural depth along this line being about 6 feet.

For the purpose of making an estimate the Board has divided the water route between the Galveston jetties and the city of Houston into three divisions for consideration. As the only method of obtaining the required channel is by dredging, these divisions are made according to the difficulty of dredging and disposing of the spoil. They are as follows:

First division. The ship channel through Galveston Bay, including the Morgan Canal.

Second division. The portion from the north end of the Morgan Canal to Harrisburg.

Third division. The portion from Harrisburg to the mouth of White Oak Bayou, in the city of Houston.

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[1] Not reprinted. Printed in House Doc. No. 99, Fifty-fifth Congress, second session.

In considering the first division, no practical difficulty in dredging presents itself except the delays from unfavorable and stormy weather. The material is easily dredged and disposed of. Owing to the length of this channel and its tendency to deteriorate, the Board has concluded that its width should be 150 feet, with slopes such as the material may assume, varying from 1 on 2 to 1 on 4. The yardage to be removed, assuming the slopes to be 1 on 4, is 18,000,000 cubic yards. It is estimated that this work can be done by hired labor and plant owned by the United States at a cost of 5 cents per cubic yard, making a total of $900,000.

To do this work economically and in reasonable time the construction of two large suction dredges is deemed necessary, and their estimated cost is $100,000 each, or $200,000 for the two.

This reach is divided into two nearly equal parts by a shell shoal, called "Red Fish Bar." It is proposed to deposit the material dredged between Red Fish Bar and Bolivar Channel, to the westward of the cut, so as to interfere as little as possible with the tidal basin in this part of the bay.

The spoil from the portion of the channel between Red Fish Bar and the Morgan Canal is to be deposited in a dike to the eastward of the dredged channel, and thus, in a measure, protect the channel from the influx of the sand and silt which move upon the bottom of the bay in heavy storms.

From the above it will be seen that the estimated cost of the channel, 25 feet deep and 150 feet wide, between the Galveston jetties and the north end of Morgan Canal, is $1,100,000.

The second division, or the portion of the waterway between the north end of the Morgan Canal and Harrisburg, presents no serious difficulty in dredging, but will cost more per cubic yard, as the dredged material will, in some cases, have to be moved a long distance. The Board estimates that this dredging, including towage and dumping, can be done at a cost of 15 cents per cubic yard. On account of the additional cost, the Board recommends that the navigable width of the channel in this portion be held at 100 feet. This will require the removal of 6,000,000 cubic yards, which, at 15 cents per cubic yard, amounts to $900,000.

The third division, or portion of the waterway from Harrisburg to Houston, being narrow and tortuous, with high banks, will require the removal of at least one bend by a cut-off and the straightening and widening of others. It is proposed to remove the point just below the San Antonio and Aransas Pass Bridge, to afford the harbor of a width of 500 feet required by the act of Congress. It is also proposed to widen the channel at the mouth of White Oak Bayou in Houston, so as to afford a turning place for vessels which may be required to go above the proposed harbor. This turning basin will allow vessels to load conveniently at any point along the bayou within the limits of the city of Houston.

The amount of dredging necessary for all these purposes, between Harrisburg and the foot of Main street, is approximately 8,500,000 yards; and owing to the extra difficulty in disposing of the spoil, the cost is estimated at 20 cents per cubic yard, making the cost of this division $1,700,000. The cost, therefore, for dredging the required waterway is estimated at $3,700,000, to which should be added $300,000 for administration and contingencies, making a total of $4,000,000.

The cost of maintenance is estimated at $100,000 annually.

The above estimates are based upon the supposition that all land necessary for the proposed channel and harbor will be furnished the

United States free of expense, and that the city of Houston will adopt some method of sewage disposal which will not be injurious to the channel.

COMMERCIAL IMPORTANCE.

At a meeting of the Board held at Houston July 26, a committee of citizens representing the local interests most concerned addressed the Board, and presented a written statement setting forth the commercial importance of the city of Houston and the proposed ship channel through Buffalo Bayou and Galveston Bay; this statement is hereto appended.

The rapid development of the resources of Texas, Oklahoma, Kansas, Colorado, and New Mexico has for many years made the establishment of a first-class harbor on the Gulf coast west of New Orleans a manifest necessity.

This necessity has been recognized by Congress, and liberal appropriations have been made for a number of years, which have finally resulted in the successful opening of a channel of magnificent proportions across the bar at Galveston, giving access to an excellent harbor in Galveston Bay. This result has cost the country many millions of dollars and has introduced a new factor in the problem of its prosperity, the full value of which can only be realized by turning to account most actively and in the most comprehensive manner the new resources which it offers to commerce.

Buffalo Bayou is an important factor in the utilization of this improved entrance to Galveston Bay. The city of Houston, at the head of navigation, is an important railroad center, where fifteen roads converge, and through it passes annually a vast commerce seeking the seaboard to reach the markets of the world. Much of this trade coming from points in the interior passes through Houston to some more distant port of shipment, but much of it leaves the railroad at this point and is shipped by barge through Buffalo Bayou to Galveston Bay, where it is transferred to ocean-going vessels in the open bay. More than 500,000 bales of cotton have recently been shipped by this route in a single year.

A conservative estimate would place at $600,000 per annum the direct saving in freight on produce shipped via the Galveston entrance which would result from such an improvement of this waterway as is contemplated in the act under which this Board is convened.

This saving of $600,000 in freight would alone justify an improvement of this magnitude, as it amounts to more than the probable cost of maintenance and the interest on the estimated first cost of the work.

The Board is, however, of the opinion that the saving on the freight actually using the Galveston entrance is but a small measure of the value of such an improvement to the farming communities of the neighboring States, as all rates to the seaboard would necessarily be affected.

Respectfully submitted.

Henry M. Robert,
Colonel, Corps of Engineers.
A. M. Miller,
Major, Corps of Engineers.
Geo. McC. Derby,
Captain, Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

STATEMENT FROM THE MAYOR AND CERTAIN CITIZENS OF HOUSTON, TEX.

HOUSTON, TEX., *July 26, 1897.*

GENTLEMEN: The project submitted through the act of Congress for your consideration embraces the extension of the ship-channel improvement inaugurated by the enterprise of Houston in 1869, carried to its first stage of success by the opening of the ship canal through Morgans Point, and the passage of steamships of 10 feet draft to Clinton station, on Buffalo Bayou, within about 8 miles of Houston, the ship channel through Red Fish Bar having been constructed by the United States Government, and the subsequent assumption of the work by the Government of the United States, resulting in the completion of a channel for vessels of 12-foot draft from the Gulf of Mexico into San Jacinto River.

The act of Congress is as follows:

AN ACT to provide for an examination and survey of a water route from the mouth of the jetties at the city of Galveston, Texas, through the ship channel and up Buffalo Bayou to the city of Houston, Texas.

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the Secretary of War be, and he hereby is, authorized and directed to make an examination and survey, with an estimate of the necessary cost, for a water channel not less than twenty-five feet deep and one hundred feet wide, extending from the mouth of the jetties at the city of Galveston, Texas, through the existing ship channel and up Buffalo Bayou to the city of Houston, Texas, and for a harbor at or near Houston of a depth of not less than twenty-five feet and of a width of 500 feet, and to make a report of such examination, survey, and estimate, with its commercial importance, to Congress.

"SEC. 2. That the cost of said examination, survey, and estimate be paid out of funds already appropriated for work on the improvement of the ship channel and Buffalo Bayou.

"Approved February 1, 1897."

The line of operations, it is understood, embraces the dredging of the natural earth bottom of Galveston Bay and the dredging of such portion of the earth deposits (there being no rock obstructions along the line of operations) in the San Jacinto River and Buffalo Bayou channel as may be necessary.

Resting upon these tidal waters, at Houston, is a railway system embracing thirteen lines, with a mileage of 5,816.68 miles, and an estimated tonnage of 9,626,000 tons. Buffalo Bayou, the waterway of Houston to the sea, has, through the transportation lines navigating its waters from January 1, 1869, to July 8, 1897, borne to the Gulf, by the record of one of its leading lines, 5,986,437 bales of cotton. The carriage in the great crop year of 1894–95 was 510,878 bales. Complete data of the tonnage of other products and merchandise are not attainable; but the movement has been vast, and at all times in active competition with the rail lines. The gross cotton receipts of Houston in the last ten years aggregate 10,640,475 bales, or an average of 1,064,047 bales per annum. Ranked as the leading interior cotton market of the United States, and with compress and trackage facilities embracing over 96 miles of sidings, all of which is connected with her bayou frontage, Houston has been enabled to create a net cotton trade, of cotton actually marketed in her exchange, embracing a total in the last ten years of 3,897,388 bales, her net business in the great crop year of 1894–95 reaching 603,833 bales. The gross receipts were 1,803,592 bales. Estimating on the basis of the present differential and Galveston wharf charges, it is claimed that the saving in the cost of export freights on this cotton alone would be not less than $756,525 in a single year if this waterway were made available for deep-draft vessels from the Gulf of Mexico. It is estimated that an average of 13.5 per cent of the cotton crop of the United States in these ten years has reached these tidal waters annually for export, coastwise, or foreign.

This cotton movement is not to be created; it is already here, seeking that outlet to the world's demand which will leave to the producer the greatest requital for his toil. Texas, whose production increased from 1,447,000 bales in 1889–90 to 3,200,000 bales in 1894–95, will continue to increase her production. If it be the generous and, as we claim, the wise policy of our Government to open this waterway to the sea, the day is not far distant when there will come to these tidal waters 3,000,000 bales of cotton to take the benefit of its action.

Amid this railway concentration and the growth of this Gulf waterway trade, the city of Houston has reached a population in 1896 of 68,997; taxable wealth, $22,827,055; banking capital employed, $2,500,000; bank clearances for last fiscal year, $231,859,636. Houston is the only national-bank reserve city for the territory west of New Orleans, southwest of Kansas City, and southeast of Denver.

The same causes which led the pioneer railway builders of Texas to commence construction on tide water, at or near Houston, operate with potent force to-day. So long as ocean, gulf, bay, and river float vast cargoes, the lengthening out of their way, to reach shorter lines of rail communication with supply and consumption, will be chief among the economies of transportation. These forces, now awaiting further development, nourished the infancy of the railway system of Texas. The same forces are a sustaining element of its present strength and an incentive to its growth.

Permeated by this system of railway is the imperial State of Texas, with its area of 265,780 square miles, embracing an extreme length of 620 miles and an extreme width of 760 miles, with a population of 3,000,000 and an assessed wealth of $850,309,000; with all the elements of climate, fertility of soil, natural products, and certainty of agricultural production necessary to sustain a vast population in the varied pursuits of agriculture, pastoral pursuits, manufactures, business, and trade. Connected with these railway systems are the great lines, reaching westerly to the great cattle pastures and mining fields of New Mexico and Arizona, and northwardly through the fertile plains of Oklahoma, now giving the promise of 29,000,000 bushels of wheat and 150,000 bales of cotton, into the great grain fields of Kansas, Nebraska, Iowa, and Colorado. The surplus products of all these regions look Gulfward for a market.

It is not, therefore, alone the trade of the city of Houston, however entitled it may be to consideration because of its connection with the commerce of the country, that is to be served by the development of these tidal water communications, but that of the State of Texas, as evidenced by the trend of its productions to these waters, and the memorial of the State legislature to Congress in behalf of the improvement under consideration, and also of the people of the great Northwest, dependent upon increased and cheaper outlets to the sea for a remunerative market for their surplus products.

The following resolutions, urging the improvement of Buffalo Bayou, were adopted by the Texas legislature at the last session:

"Whereas it is a recognized principle in the philosophy of commerce that the sooner the products of any State or section reach navigable connection with the high seas the greater will be the return for the labor of the producer; and

"Whereas the system of jetty improvements at Galveston by the General Government has been carried to a complete success; and

"Whereas an appropriation has been made by Congress for the survey of Buffalo Bayou and its connections from the jetties at Galveston to Houston: Therefore, be it

"*Resolved by the house, the senate concurring*, That we do hereby express our gratification at the success of the deep-water movement at Galveston, and record the hope that all the expenditures therefor may be fully realized, and, believing that it will be a success and great benefit will result from the opening of a navigable waterway from the jetties at Galveston to the city of Houston, we do tender the thanks of this body to our Senators and Representatives in Congress and to the Senators and Representatives of other States who aided in securing an appropriation for the work at Galveston and for the survey of Buffalo Bayou to Houston; and be it further

"*Resolved*, That this body does indorse and approve the contemplated work of the improvement of Buffalo Bayou by the means of appropriations by the General Government as a measure of great and general interest, not only to the people of Texas but to the people of all that vast and productive territory lying west of the Mississippi River, who will find through said waterway, by way of the jetties at Galveston, a natural outlet to the markets of the world, whereby will be avoided the great delay, expense, and loss resulting from the haul by rail across the continent to other ports; be it further

"*Resolved*, That our Representatives and Senators in Congress be, and they are hereby, requested to give their aid toward securing the necessary appropriations to carry to successful completion the work of the improvement of Buffalo Bayou until it is opened as a navigable waterway for the largest seagoing vessels to the city of Houston; be it further

"*Resolved*, That a copy of these resolutions be transmitted under the hand of the speaker and chief clerk to both Senators from this State and each Representative-elect from Texas to the Fifty-fifth Congress."

When the project of a ship channel from Houston to the sea was first presented, the exit from the great Bolivar Basin to the Gulf was obstructed by the 13-foot outer bar. We feel a pride in saying that throughout the whole efforts of the people of Galveston, and of the State of Texas, and of the Northwest, to secure the removal of that bar, the people of Houston and their immediate Representatives in Congress have given those efforts an open and cordial support, recognizing its preeminent importance. The benefits derived by our commerce from the progress already made upon the ship-channel improvement in Galveston Bay as originally inaugurated are gratefully appreciated; but we respectfully claim that we have a share in the success of the jetty construction, and that the changed conditions of navigation and the competitive necessities of commerce warrant the expansion of the project as submitted for your consideration under the act of Congress.

With a good portion of this waterway already affording a broad channel of from 20 to 25 feet in depth above its confluence with Galveston Bay, these waters, after receiving those of the Trinity River, debouch upon the Bolivar Basin, stretching from the head of the great Galveston jetties to their confluence, a long distance above the entrance to Galveston, and with an area and depth recognized as having precedence over any harbor of the western Gulf. Its improvement, uniform with the depth obtained through the jetties, seems to be in the line of progressive development and essential to secure to the peoples interested the complete benefit of the great expenditure made by our Government in the construction of the jetties and the removal of the outer Galveston Bar.

We respectfully claim that these important results will thus be secured, viz:

An interior harborage, in tidal waters, free from barnacles and the teredo and of superior steam qualities, sufficiently near to the sea and yet protected from storms and the enemy in case of war with a great naval power.

The freedom of commerce on a large extent of deep-water frontage alongside of elevators, compressors, mills, warehouses, etc., located on the banks above overflow, and climatic conditions favorable to preservation of grain.

Close connection with the rail transportation interests and export trade already established at the tidal railway center of Houston.

The crowning feature of the progress of the last quarter of a century has been the development of the harbors and waterways of our country. Since 1873 the appropriations for this purpose have been $251,721,812. In that period the results of these expenditures have exercised a vast influence upon our commercial position and the advanced prosperity of our people. Among the improvements accomplished are the removal of the Hell Gate obstructions and the improvement of the approaches to the harbor of New York; the construction of the great Delaware Breakwater and the improvement of the approaches to the harbor of Philadelphia; the construction of the St. Clair Flats Canal, opening the way for a commerce with the Great Lakes estimated at $275,000,000 annually; the improvement of the approaches to the harbors of Baltimore and Mobile, along a long line of dredged channel; the improvement of the harbors of Savannah and Charleston; the great Galveston jetties, removing the Galveston Bar, and opening the way into the great Bolivar Basin and into Galveston Harbor; the Sabine Bar jetties, making the harbor of Sabine Pass available for deep-draft shipping; the removal of the Brazos Bar; improvement of the channel and outlet of the Mississippi River, and the control of its waters for the protection of the regions along and contiguous to its course, signalized by the last great triumph over its raging floods. Along the North and South Atlantic Coast, and around the Gulf to Appalachicola, and in the tidal waters and bays, up through the water courses of the States (some great, some small); now blasting the way from the great Warrior coal fields to the Gulf; along the Great Northern Lakes and their tributary streams; on the far Pacific Coast, where the Columbia flows, and far up into the waters of Washington and Idaho, these appropriations have been the inspiration of improved water communications. In addition to the outlays named, provision is made under continuous contracts for the completion of a number of the important waterway improvements of the country, the estimate of the Chief of Engineers for the prosecution of such works in 1898 being $22,778,053.16.

The vast field covered by these works, the difficulties that have been surmounted by the skill and genius of your distinguished corps of the Army of the United States, and the beneficent results have excited the wonder and admiration of mankind and commanded the appreciation and thanks of the American people.

The period named marks the era of the most wonderful progress of our country. Just following the completion of the great railway lines to the Pacific Ocean, the development of these waterways and harbors has expanded the business of existing railway lines and been the incentive of new railway enterprises, with resultant development of dormant regions, from which the railway system as a whole has drawn compensatory business. The railway mileage in 1873 was 70,268 miles. In 1896 it was 179,821 miles of main line and 55,209 miles of sidings. In 1870 the tonnage movement of our railway lines is stated at 71,197,302 tons. The tonnage movement in 1896 is stated at 763,799,883 tons. The population in 1873 was about 41,000,000; it is now estimated at 70,000,000. The national wealth was then about $37,000,000,000; it is now estimated to be $69,000,000,000. The tonnage engaged in our coastwise and interior trade was then 3,163,000 tons, of which but 110,511 tons was iron steam tonnage. This tonnage had increased in 1896 to 3,790,296 tons. There were built in the United States in 1896 iron steam vessels embracing 96,388 tons, besides 16,832 tons of iron sailing vessels and barges, under the impetus given by the development of our water communications. There was built in the United States from 1873 to 1896 iron steam tonnage amounting to 992,982 tons and iron sail tonnage amounting to 63,741 tons. Our foreign trade for the fiscal year 1873 was $1,147,169,649, with a balance of trade against us of $137,102,771. Our foreign trade in 1897 was $1,797,372,785, with a balance of trade in our favor of $268,624,975. These facts evidence the harmonious development of all our material interests with that of our tidal and interior waterways.

These data are thus brought to your attention in evidence of the fact that it has become the settled policy of the United States to develop its waterways to the highest standard of usefulness justified by present or prospective conditions and within the limit of reasonable outlay and practicability. We are here to invoke that policy in behalf of this project, confident that its merits will receive your careful consideration. We believe that precedent justifies the improvement of this waterway to the sea, and that its position, importance, existing and prospective commerce, and its promise of value to the producers and consumers of our country bring it at least within favorable comparison with many of the works carried to successful completion by the Government.

The amount expended by the Government on the ship channel in Galveston Bay from 1871 to 1896, inclusive, has been $676,320; and in the improvement of Buffalo Bayou, $208,318. The June 30, 1896, report of Maj. A. M. Miller, Corps of United States Engineers, in charge, says:

"The work done has afforded an outlet to the Gulf for a large amount of traffic which would otherwise have had to seek rail or light-draft transportation to deep water. The cost of the improvement has been small as compared with the value of the commerce involved."

While the cotton trade of Texas and the relation of the tidal waters of Buffalo Bayou to its concentration and movement may be regarded as of first importance in relation to this project, the position of Houston as a lumber, wool, sugar, rice, grain, cattle, and hide market, and the prospective development of this trade under the influence of deep-water navigation, are entitled to consideration. The lumber tonnage entering Houston by rail annually is estimated at 631,509 tons. The coastwise tonnage from Louisiana, Mississippi, Alabama, and Florida points is to be added. The advantageous position of these interior tidal waters for a lumber, coastwise, and foreign export trade, arising from their contiguity to the vast forests penetrated by our railway lines and the certainty of return loading for cars carrying lumber from the mills, is evidenced by the memorial of the mill owners in interest, representing an annual output capacity of 394,000,000 feet of lumber, submitted January 30, 1897, to Hon. W. B. Hooker, chairman of the Committee on Rivers and Harbors of the House of Representatives of the Fifty-fifth Congress in behalf of the project, during the inspection of this waterway by its subcommittee. This memorial says:

"Such improvement will be of great benefit to our industry, and will give an opportunity to market a large per cent of our products by sea, whereas we are now confined to domestic trade, which has been very uncertain as well as unsatisfactory during recent years. We can not reach any of the present deep-water ports with our lumber on competing rates for export, and are consequently shut out from the growing demand for Texas lumber in foreign markets. Our close rail connection with Houston will enable us to reach that city with our products, so as to take advantage of deep water in Buffalo Bayou."

In the leading products, in addition to cotton and lumber, forming the bulk of our coastwise and foreign trade, the position of Texas is important. Her rank in 1895 was seventh among the great corn-producing States, the product being 107,905,565 bushels. She is first in rank in the great sheep-growing States, having in 1896 a total of 3,065,256 sheep, or about one-twelfth of the whole flocks of the United States. Her cattle in 1896 is estimated by the United States Agricultural Bureau at 6,302,580, or over one-sixth of the whole cattle of the United States. Her swine, by the census of 1890, was 2,202,476, occupying the eighth rank of States in hog production. The statistics of the swine breeders' associations of the country show that the improved breeding of swine in Texas in the last five years has been marked. The increased number of swine rendered for assessment in 1896, as compared with 1895, was 309,898.

In addition to these productions of Texas, contributing to the coastwise and foreign export trade of the United States, are to be considered the agricultural and pastoral products of States and Territories lying to the northwest and north of Texas.

The grain movement for export gulfward is now the most interesting problem of transportation. With low prices, enormous crops, and a vast surplus in the Northwestern States, distant from 1,300 to 2,000 miles from the Atlantic Seaboard, the movement to the Gulf outlet, upon greatly reduced mileage, is a natural result. This influence of cheaper transportation operates upon the movement of all agricultural products for export.

The total domestic exports of the United States for 1896 was $986,844,193. Of this, 67.37 per cent was products of agriculture, and, including productions of the forest, were 70 per cent of the whole. In the exports of breadstuffs the increase in corn was 70,003,892 bushels; of oats, 28,478,877, and of wheat, 16,951,143 bushels.

Of the corn production of the United States in 1895, 40 per cent was produced by the States of Kansas, Nebraska, Iowa, and Texas. Of the wheat production of the United States in 1895, 12.6 per cent was produced by the States of Kansas, Nebraska, Iowa, Colorado, Texas, and Oklahoma Territory, and of oats the States of Kansas, Nebraska, Iowa, Colorado, and Texas produced 32.7 per cent, Iowa alone producing 182,967,338 bushels, or 151,175,510 bushels in excess of the entire oats export of the United States in 1896.

The estimate made by the Agricultural Bureau of the number of cattle in the United States in 1896 was 48,222,995. Of these, 13,508,941, or 28.1 per cent, were in Texas, Kansas, Nebraska, New Mexico, Colorado, Indian Territory, and Arizona. The foreign exports of live cattle in 1896 embraced 394,772 head; of fresh beef products, 282,925,463 pounds; of salted beef products, 85,893,296 pounds, and of tallow, 85,449,086 pounds, and of canned beef, 61,168,927 pounds.

The question of decreased distance of rail transportation for these vast products enumerated must be a controlling element in their home value to the producer. The following list of distances to tide water, at Houston, is given:

	Miles.		Miles.
Oklahoma City, Okla	493	Omaha, Nebr	941
Guthrie, Okla	524	Lincoln, Nebr	943
Arkansas City, Kans	613	Kearney, Nebr	1,079
Wichita City, Kans	665	Superior, Nebr	901
Dodge City, Kans	860	Santa Fe, N. Mex	1,092
Topeka, Kans	760	Denver, Colo	1,098
Parsons, Kans	612	Pueblo, Colo	973
Des Moines, Iowa	970	Sioux City, Iowa	1,049

The increased value of foreign exports via the Gulf ports in 1896 was $53,624,393, reaching a total of $182,513,869, notwithstanding the low value of products. The heaviest proportionate increase was via the Galveston jetties, $19,853,156, or over 50 per cent. The increase in the export movement via the jetties for the ten months of 1897 is $21,307,697, or 60.8 per cent.

The gigantic schemes now pressed for the construction of deep waterways from the Great Lake ports to the Atlantic Seaboard, and the measures already adopted for the improvement of the Erie Canal, are doubtless justified by the vast increase of our products and the vast interests connected with the movement of these products; but the fact remains that the natural trend of agricultural exports of the Mississippi region is gulfward along the lines of shorter distance and climatic conditions permitting unbroken communication, and the conviction is pressing upon the minds of the thoughtful men of these States that this affords their best if not the only means of relief.

Houston is the first tidal point touched by the Southern Pacific Railway system on its line from the Pacific Ocean through Texas; its vast system, embracing steamships and rail carriage with numerous affiliated lines, has the Gulf of Mexico at command as the center of operations.

It is about 650 miles from Houston to Vera Cruz, and about 800 miles to Havana. Houston is the nearest Gulf railway center for the trade of Yucatan, Central America, the Greater Antilles, and the countries of the Caribbean Sea. It is the first available tidal point for transportation of freight seaward of the great railway lines penetrating Mexico from the Texas border. The expansion of our trade with these countries of the Gulf and Caribbean Sea is essential to our prosperity. We are their neighbors, and bound to them in the sympathy common to free government. We must enter the contest with the foreigners who are in possession of their trade and wrest it from them by the advantage of closer maritime relation, reciprocal trade, and mutuality of national feeling and interest.

Apart from consideration of trade, the opening of the deep waterway from the Bolivar Basin into the waters of the San Jacinto Bay and River, it is urged, will afford a harbor of refuge for our Western Gulf commerce and for the concentration of our gunboat, monitor, and ram defenses in case of war with a great naval power harassing our coast.

While we claim that even under existing tidal conditions the position of Houston as a cotton export market and as the freight distributing center of Texas is on a plane of economics beyond the reach of present rivalry, and that water and rail facilities are at command for the present business upon the basis of competitive expense, yet this affords no sound argument against this project, which will permit a cheaper and more rapid conduct of commerce. It is not only a question of freights, but also of expenses. We know also that with the shipping of the world at closer command the application of our economics will enable us to attract and create a trade that otherwise would be beyond our reach. We realize that maritime commerce is not the mere creature of deep water, but that it must be unshackled, free from onerous exactions, and fostered with liberal care, and we believe that in the nearest possible approach to the base of supply and consumption lies the greatest of all the economics of shipping.

We respectfully claim that the beneficent results to the commerce of the country which will follow the development of this waterway to the sea, as submitted under the act of Congress for your consideration, will justify the outlay necessary to be made in its behalf.

Reference is respectfully made to the accompanying "Statistics of Houston, Tex."

Respectfully submitted.

H. B. RICE,
Mayor of Houston.
H. W. GARROW,
President Houston Cotton Exchange and Board of Trade.
R. D. GRIBBLE,
President Houston Business League.

Col. H. M. ROBERT, *Corps of Engineers, U. S. A.*,
Maj. A. M. MILLER, *Corps of Engineers, U. S. A.*,
Capt. GEO. McC. DERBY, *Corps of Engineers, U. S. A.*,
Board of United States Engineers.

STATISTICS OF HOUSTON, TEX.

Population, finance, trade, manufactures, public improvements, progressive institutions, etc.

Houston, Harris County, Tex., is the tidal railway center of Texas, located on Buffalo Bayou, about 55 miles by tide water from the Bolivar Basin, at the head of the jetties connecting it with the Gulf of Mexico. Houston was created a port of delivery of the United States about the year 1879.

Houston has, according to the last local census (December, 1895), a population of 68,997. Taxable wealth, $22,027,055.

Houston is a national-bank reserve city. National banks, 5; private banks, 2; capital invested, estimated, $2,500,000; bank clearances, fiscal year ending June, 1896, $219,905,291; bank clearances, fiscal year ending June, 1897, $231,859,636.

Homestead, real estate, and loan associations, 22; capital, $3,000,000.

Incorporated capital invested in water transportation, steam and barge lines, estimated, $350,000.

Incorporated capital invested in manufacturing and industrial establishments of all grades, including 6 cotton compresses and 4 cotton-seed-oil mills, estimated, $4,600,000.

Sales of merchandise, manufactured articles and lumber, in 1896, estimated, $29,500,000.

Cotton receipts (net handled in the market), crop of 1896 to July 8, 1897, 492,597 bales. Increase over entire season of 1896, 38,113 bales. Gross cotton receipts, crop of 1896, 1,318,389 bales. Increase over entire season of 1896, 157,596 bales.

Gas works, 1, with plant of capacity for 100,000 population. Length of gas mains, 24 miles.

Public schools: White schools, 9; colored, 6. Private schools for white pupils, 22. Valuation of public-school buildings, $363,650.

Public buildings: County court-house, criminal court and jail, city hall and central market, United States post-office, cotton exchange and board of trade, Lyceum Hall and public library, State fraternal edifices, St. Joseph's Infirmary, Faith Home, and churches of all denominations, some of them the largest and finest in the State.

Newspapers: Daily, 3; weekly and monthly, 11.

Electric lights, 1 plant, complete service.

Waterworks, with two standpipes for either river or artesian-well supply; artesian water now used exclusively; average daily supply, 3,000,000 gallons. Fire hydrants, 430.

Artesian wells: There are 39 flowing wells in the city, having a depth of 130 to 1,200 feet; supply regarded inexhaustible; least flow, 15 gallons per minute, and greatest flow, 600 gallons per minute.

Electric street railway: One system, embracing 13 lines; length of track, 35 miles completed, 6 miles under construction. Suburban railway, 1 line.

Street improvements: Length of streets paved with brick, gravel, rock, slag, cypress, live oak, and bois d'arc, 14.3 miles; in course of contract, 2½ miles. Special fund for street paving provided, $250,000.

Waring sewerage system: Length of sewers, 24 miles.

Statement of business of the Houston post-office for the year 1896: Gross revenue, sale of stamps, etc., $80,279; net revenue, $47,775; deposits by other postmasters, $91,905.63.

The principal trade of the city of Houston is in Texas products, viz, cotton and cotton-seed products, sugar, molasses, rice, and vegetables and fruits for early shipment, lumber, wool, and hides.

Railway lines centering at Houston: Number of railways, 13; length of railway mileage, 5,816.68 miles.

Houston is the base and general office location of two of the Texas lines operated in harmony with the Southern Pacific system, embracing 6,032 miles of railway, and 7,276 miles of steamship lines.

The central machine shops of several trunk lines are here located.

Cotton movement gulfward via Buffalo Bayou (from records of the Direct Navigation Company):

	Bales.
January, 1869, to March, 1890	3,767,109
Season 1890–91	295,517
Season 1891–92	327,738
Season 1892–93	272,416
Season 1893–94	276,932
Season 1894–95	510,878
Season 1895–96	319,407
September 1, 1896, to date, 1897	320,440
Total cotton carried, 1890 to 1897	2,323,358
Total cotton carried, 1869 to 1897	6,090,467

Houston cotton receipts, in comparison with the Texas and total crops for the past ten years:

Seasons.	Net receipts.	Gross receipts.	Texas crops. *a*	Total crops.
1887-88	174,650	641,159	1,407,000	7,047,000
1888-89	211,246	675,504	1,463,000	6,939,000
1889-90	310,783	794,601	1,770,000	7,297,000
1890-91	367,394	985,084	2,000,000	8,674,000
1891-92	434,317	1,135,872	2,400,000	9,035,000
1892-93	465,937	1,119,282	2,108,000	6,667,000
1893-94	382,147	1,106,199	2,059,000	7,552,000
1894-95	603,833	1,803,592	3,276,000	9,901,000
1895-96	454,484	1,160,793	1,990,000	7,157,000
1896-97 *b*	492,597	1,318,389	2,135,000	*c* 8,350,000

a Includes Indian Territory. *b* To date, July 1, 1897. *c* About.

The following is a consolidated statement of the tonnage to and from Houston by seven of its railway lines, from which data have been obtained, for the years 1895 and 1896:

	1895.	1896.
	Tons.	*Tons.*
Cotton	466, 754	447, 623
Cotton seed	119, 633	157, 801
Cotton-seed products (including hulls)	101, 230	84, 918
Sugar and molasses	101, 793	80, 575
Hay	28, 515	29, 687
Grain, all kinds	126, 590	192, 938
Grain products	75, 951	94, 120
Hides and wool	54, 915	43, 698
Live stock	74, 765	84, 349
Lumber, timber, shingles, ties, staves, etc	1, 012, 410	855, 297
Stone and brick	350, 899	590, 179
Iron and metallic ores	59, 666	77, 010
Coal	189, 424	175, 791
Miscellaneous	748, 147	744, 412
Total	3, 510, 692	3, 658, 398

Detailed statement of tonnage of other roads not obtained.

Tonnage transported through Buffalo Bayou by the Houston Direct Navigation Company for the years 1894, 1895, and 1896, total, 346,481 tons.

Rock transported from Houston through Buffalo Bayou by contractors for the Galveston jetties during the years 1893, 1894, 1895, 1896, and 1897 (to July 20), total, 346,102 tons.

V 10.

REPORT OF BOARD OF ENGINEERS ON EXAMINATION OF CHARACTER AND VALUE OF IMPROVEMENTS MADE AT THE PASS OF ARANSAS, TEXAS, BY THE ARANSAS PASS HARBOR COMPANY.

[Printed in House Doc. No. 137, Fifty-fifth Congress, second session.]

Corpus Christi, Tex., *November 22, 1897.*

Sir: The Board appointed to ascertain the character and value of the improvements made at Aransas Pass, Tex., by the Aransas Pass Harbor Company, has the honor to submit the following report:

The Board was appointed by the following orders:

Special Orders,
No. 145.

War Department,
Adjutant-General's Office,
Washington, June 23, 1897.

[Extract.]

* * * * * * *

6. The following order is published for the information of all concerned:

War Department, *Washington, June 22, 1897.*

By direction of the President, in accordance with a provision in the act making appropriations for sundry civil expenses of the Government for the year ending June

30, 1898, approved June 4, 1897, a Board of Engineer Officers, to consist of Colonel Henry M. Robert, Major William T. Rossell, and Captain John Biddle, Corps of Engineers, is appointed to meet at Aransas Pass, Tex., upon the call of its senior member, and at such other places, from time to time, as he may deem necessary, for the purpose of ascertaining the character and value of the improvements made at the Pass by the Aransas Pass Harbor Company. The Board will make its examinations, and its report of the result of the same, as required by the act cited, and after each meeting and upon the completion of the duty, will return to their proper stations.

The travel enjoined is necessary for the public service.

R. A. Alger,
Secretary of War.

* * * * * * *

By order of the Secretary of War:

Sam'l Breck,
Acting Adjutant-General.

The act of Congress cited states as follows:

> That for the purpose of ascertaining the character and value of the improvements made at the Pass of Aransas, on the Gulf coast of Texas, by the Aransas Pass Harbor Company, a board of three engineers shall be appointed by the President, from the Engineer Corps of the Army; and such board shall personally make examination of the work done by said company for the purpose of deepening the channel and removing the bar at or near said Pass of Aransas.
>
> It shall be the duty of the board so constituted to report the depth of water upon the bar at the time of their examination; the character of the work done and the cost of same; the character and cost of any unfinished work contracted to be done by said company; the probable result upon the deepening of the channel across the bar of any work contracted for or contemplated by said company, but not then finished; the value to the Government of all work done or contracted to be done by said company for the purpose of deepening said channel or removing said bar, and such other information as they may deem essential to be known to Congress in making future provision for the purchase of said works by the United States Government.
>
> Said board shall report the result of their investigation to the Secretary of War on or before the first Monday in December, eighteen hundred and ninety-seven, and the Secretary shall immediately transmit the report to Congress; and five thousand dollars, or so much thereof as may be necessary, is hereby appropriated to pay the expenses of the said board and for the services of the said engineers, the amount of such compensation for said services to be fixed by the Secretary of War.

The Board met at the city of Aransas Pass on July 20, 1897. It was here joined by Mr. Thomas H. Franklin, president, and Mr. T. B. Wheeler, secretary, of the Aransas Pass Harbor Company. Accompanied by these officials the Board went by sailboat to Tarpon, at the head of Mustang Island, where the chief engineer of the company, Mr. W. D. Jenkins, has his office.

Two days were spent here examining the conditions of jetties and other works, looking over the company's maps, and obtaining general information. The Board, accompanied by the chief engineer of the company, went through the channel and over the bar, took soundings along the pilot range across the bar, and found a least depth of 8.8 feet reduced to mean low water.

On July 22 a public meeting was held at Rockport to give parties interested an opportunity to express themselves and submit any documents desired. A similar meeting was held at Corpus Christi July 24. On July 23 the records, charter, etc., of the Aransas Pass Harbor Company were examined at the city of Aransas Pass.

The president of the Aransas Pass Harbor Company was requested to furnish the Board with a complete history of the company, giving the work done and the results accomplished, with detailed statement as to cost; also, copies of acts of incorporation and charters under which the company has been working; list of bonuses given to the company; copies of specifications, agreements, and contracts; complete statement of bonds and stock issued by the company; estimate of work yet to be done; statement of commercial statistics; map showing location and character of works, with changes and results accomplished, and any additional facts the company might wish to present that would throw light on the question as to the value of these works of improvement to the Government of the United States.

The report of the president is appended, marked "A."

The Board subsequently met at Washington, September 21 and 22, 1897, when a hearing was granted to representatives of the company from Baltimore, Md. Maps obtained from the harbor company, from the Coast and Geodetic Survey, and from the United States Engineer Office, under which the work at Aransas Pass had been carried on in the past, were examined, and the subject investigated and discussed as far as the data on hand permitted.

A member of the Board went to Aransas Pass on October 31, and remained until after the meeting of the Board at Tarpon, November 16 to 18, in order to take soundings on the bar and in the channel. During this time there was, after a day or two had been passed making necessary preparations and obtaining assistants and crew, only part of one day that satisfactory soundings could be taken on the bar on account of the roughness of the water. The soundings on the bar and in the channel were taken and platted with the assistance of Mr. W. D. Jenkins, chief engineer of the Aransas Pass Harbor Company.

A chart of the soundings is appended. (Map 5.)

The Board met at Tarpon, Tex., November 16 to 18, and held a final meeting at Corpus Christi, Tex., November 19 to 22, 1897.

GENERAL DESCRIPTION OF ARANSAS PASS.

Aransas Pass is on the south coast of Texas, about 175 miles southwest of Galveston and 125 miles north of the mouth of the Rio Grande. The general characteristics of the harbors on the coast of Texas are described in a report of a Board of Engineers of November 11, 1887, as follows:

> These harbors all have characteristic features in common. A sandy cordon, thrown up by the waves and littoral currents due to winds, extends along the whole shore, often forming a series of lagoons between itself and the mainland. The rivers of Texas are small, and at seasons of low water have too insignificant discharges to scour their outlets into the Gulf. The lagoons, shallow and often mutually connected, cover inside the passes extensive areas; but unfortunately the tidal oscillation which supplies the only constant power available for deepening the passes through the cordon is only about 1 foot in height. Hence the volume of tidal flow to and from the lagoons is ordinarily small, and the currents consequently weak, notwithstanding the immense areas of many of these basins. When, however, long-continued southeasterly gales have raised the water level behind the cordon several feet, a sudden norther will force out an immense volume, and in so short a time as to generate a current destructive to ordinary contraction works. (Report Chief of Engineers, 1888, p. 1299.)

Aransas Pass is the outlet of Aransas Bay to the Gulf of Mexico. The area of the bay is about 80 square miles. It is connected with Corpus Christi Bay on one side and with the shallow bays of Mesquite, St. Charles, and Copano on the other. The total area is about 350 square miles. (Report Chief of Engineers, 1888, p. 1316.) These bays are further connected by narrow passes with other lagoons and bays.

Aransas Pass lies between the island of St. Joseph on the north and Mustang Island on the south, and for many years moved in a southerly direction, until it is now 3 or 4 miles south of the southern end of Aransas Bay proper. The annual rate of movement from 1868 to 1878 was about 260 feet. Partial protection in 1882 of the head of Mustang Island reduced this to about 70 feet a year, and work done from 1887 to 1889 has prevented any further movement. (Report Chief of Engineers, 1888, pp. 1312-1314.)

The depths, widths, and cross sections at the gorge of the pass between St. Joseph and Mustang islands have varied as follows:

Year.	Maximum depth.	Width at— Surface.	Width at— 10 feet depth.	Width at— 20 feet depth.	Area of cross section.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Sq. Feet.*
1868	29	2,810	800	230	18,412
1871	30	2,500	1,350	770	26,795
1878	27	3,040	850	460	21,700
1882	33	2,770	600	375	20,833
1885	30	2,000	600	310	19,041
1887	38	1,785	750	500	17,250
1895	31	1,500	650	430	19,500
1896	45	1,200	900	450	21,000
1897	45	750	625	550	19,000

These figures from 1868 to 1887 are taken from the Report of Chief of Engineers, 1888, p. 1316, and from chart in United States Engineer Office, 1887. For 1895 and 1896 they are taken from maps furnished by harbor company, and for 1897 from chart of soundings taken under direction of Board of Engineers.

The exact width is difficult to ascertain on account of the low, projecting, unstable point of St. Joseph Island. The cross section is taken at the narrowest point of the gorge, but the maximum depth given is not necessarily at that point. The map of 1897 shows that at a point several hundred feet nearer the Gulf than the narrowest part of the gorge the width is 1,000 feet and the area of cross section only 16,000 square feet.

The obstruction to navigation is the sand bar outside of the gorge, over which the depth between 1851 and 1890, when the harbor company was organized, has varied back and forth between 7 and 10½ feet at mean low tide. This last depth is given on map of United States Engineer Department of 1885 and in Reports of Chief of Engineers for 1885, p. 1465, and for 1886, p. 1331. It is stated that at times there has been 12 feet on the bar. (Report Chief of Engineers, 1879, p. 931.) No maps, as far as known, show this depth. The channel across the bar has always been very unstable, shifting often in a short space of time from the north to the south breakers.

The usual range of tide is about 1.1 feet, but in time of storms it is sometimes increased to five or six times that amount. (Report Chief of Engineers, 1888, p. 1316.)

Opposite the pass on the inside lies a large, low island called Harbor Island, formed chiefly of mud, and therefore more permanent than the sand islands. Between this island and St. Joseph Island is a deep channel, which constitutes the harbor. Docks and terminal facilities could best be built on Harbor Island, although St. Joseph Island might possibly be used also but not as satisfactorily, on account of the distance to the main shore, and its sand formation. The area of the harbor varies somewhat from time to time. Within the 24-foot curve it was 64 acres in 1868, and 97 acres in 1878 (Report Chief of Engineers, 1888, p. 1313), and about 60 acres in 1889 (Report Chief of Engineers, 1890, p. 1788). The survey of the United States Engineer Department of 1887 shows a channel of 18-foot depth between Harbor and St. Joseph islands, about 2 miles long, with a general width of about 400 feet; about half of this length has a depth of 20 feet or over. The company's maps of 1895 and 1896, show about the same frontage, with slightly increased depths. The harbor company claims ownership of 929 acres on Harbor Island, extending on a narrow strip along the channel for 3 miles, and of about 700 acres on lower end of St. Joseph Island. The latter was given as a bonus to the company, and lies in alternate quarter-mile strips across the island. (Map No. 2.) Harbor Island is very low, frequently overflowed, and must be filled in before it can be used for terminal facilities.

On Aransas Bay, 12 miles from the pass, is the town of Rockport, and at the head of Corpus Christi Bay the city of Corpus Christi, with about 5,000 inhabitants. The new city of Aransas Pass, 7 miles northwest of the pass, and back of Harbor Island, is on a small bay called Red Fish Bay. These places are all on the San Antonio and Aransas Pass Railway, and Corpus Christi is also the terminus of the Mexican National Railroad. A railroad track has been laid from the city of Aransas Pass out toward Harbor and Mustang islands, but as yet it reaches only to the channel leading from Corpus Christi Bay to Aransas Pass, which channel goes around Harbor Island, and between the latter and St. Joseph Island. Only about 7 to 7½ feet depth can be carried to Rockport and Corpus Christi, although the general depth of Corpus Christi Bay is about 14 feet, and of Aransas Bay 12 feet. The other bays are much shallower. A map of the bays is appended, marked "Map 1."

The possible commerce of the port is given in the appended report of the president. There is but little commerce through the pass at present. A weekly steamer to Galveston has been recently put on, and has been running for about two months. Before 1890 there were regular lines of steamers and considerable trade. A summary of the commercial statistics for the years from 1879 to 1890 is given in appendix. (Exhibit B.) The falling off of commerce has been due mostly to the building up of the railroads, as by these means freight, especially to and from interior towns, can be handled with more certainty and regularity. It is claimed that the development of Galveston Harbor probably also affected the commerce through Aransas Pass.

PROJECTS AND WORK DONE BY THE UNITED STATES GOVERNMENT.

The first official report upon the subject is that by Lieut. George B. McClellan, January 13, 1853. (Ex. Doc., vol. 2, 1853–54, p. 561; Report Chief of Engineers, 1880, pp. 1260–1261.) He states that the channel on the bar shifted in a week from the north to the south breakers, giving 9 feet in the new and leaving 4 in the old channel. A report of Lieut. Commander H. S. Stellwagen, United States Navy, to the Superintendent of Coast Survey, of May 4, 1853, makes the statement that the channel was continually shifting, but generally gave about 9 feet over the bar. The maps of the Coast Survey of 1851 and 1853 show 9 feet.

The first attempt at improvement was made about 1868, with a subscription of $10,000 raised by the citizens of Rockport. This was expended under the direction of a Mr. Halliday in building a dike about 600 feet long on St. Joseph Island, located about one-half mile from the indicated channel of 1869. It was said to have been built of parallel rows of triangular cribs filled more or less with brush and stone. It was claimed to have deepened the main channel 2 feet by closing a swash channel. It was soon carried off by the storms. On a survey made in 1871 no sign of it could be found. (Reports Chief of Engineers, 1871 and 1879.)

An act of Congress of July 11, 1870, directed a survey to be made of the approaches to Corpus Christi. This was done under the direction of Capt. C. W. Howell, Corps of Engineers, by Lieutenant Woodruff, Corps of Engineers, and included Aransas Pass. Several plans of improvements were suggested but none recommended, and no appropriation was made. (Report Chief of Engineers, 1871, p. 526.)

By act of June 18, 1878, an examination and survey of Aransas Pass and Bay up to Rockport and Corpus Christi was ordered. This was made under direction of Captain Howell, by Mr. H. C. Collins, assistant engineer, in the late summer and autumn of 1878. Captain Howell presented a project for the improvement of the pass, which was submitted to a Board of Engineers. The project recommended by this Board was as follows: To extend parallel jetties from south end of St. Joseph Island and the north end of Mustang Island, contracting the width of waterway, and carried out to a sufficient distance to afford a draft of 12 feet at mean low water over the bar, and to construct groins for the protection of the head of Mustang Island up to and beyond Turtle Cove, in conjunction with a beach flooring of mattresses, and to plant trees upon St. Joseph Island for its protection against abrasion by winds. (Report Chief of Engineers, 1880, p. 1262.) These jetties were to be about 3,000 feet apart, of combined mattresses and stone. The estimated cost was $759,185. General Newton, a member of the Board, considered it would be better to build the Mustang Island jetty first, thinking it might prove sufficient by itself.

Work was begun in May, 1880, and carried on from 1880 to 1885 under Col. S. M. Mansfield, Corps of Engineers. The work was done generally under small appropriations, by hired labor, obtaining the stone and brush by contract; later it was carried on entirely by contract. A storm in August, 1880, carried off a large part of the work. In 1883, the funds being exhausted, $10,000 was subscribed by citizens of Rockport and Corpus Christi to be spent under direction of the engineer officer in charge. This was applied to continuing the contract. When new appropriations became available work was continued, mostly by contract, until April, 1885, when it was suspended. The work then consisted of a protection to Mustang Island by seven groin jetties, a breakwater and revetment along channel face of the island, sand fences on heads of both islands, and a south jetty, 5,500 feet long, of which 1,500 feet was shore work and 4,000 feet jetty proper. The inshore end was built up to ordinary high water for 3,300 feet, the remainder from 3 to 14 feet below high water. The jetty was constructed of brush mattresses and stone, and the high portions of inshore superstructure capped with piles and stones. (Report Chief of Engineers, 1886, p. 1331.) These caps were intended to be only temporary. The jetty started from Mustang Island and ran out to near the wreck of the steamer *Mary*, continuing by a sharp curve to the north. The *Mary* was a sidewheel steamer of the Morgan Line, wrecked November 30, 1876. Its location is shown on the maps accompanying. Even before completion work was seen to be settling badly, due probably to the teredo. A storm in September, 1885, carried away the top works, and the whole structure was injured by this and other storms. No north jetty was built.

The amount expended by the Government up to July, 1887, was—

Appropriations	$383,618.02
Private subscriptions	9,938.93
	393,556.95

(Report Chief of Engineers, 1887, p. 1432.)

In view of the injury sustained by the works, and the lack of results, a new survey was made in March, 1887, under direction of Maj. O. H. Ernst, Corps of Engineers. He reported that the protection of Mustang Island had partially accomplished the object by reducing the cutting to 70 feet a year, but the works were greatly damaged and new ones would have to be built to the rear; that the single jetty had but an insignificant effect, giving only 8½ feet depth; that the channel was across the jetty, which was in a dilapidated condition; and that the sand fences and trees had entirely disappeared. (Report Chief of Engineers, 1888, pp. 1313 to 1315.)

Major Ernst submitted a project for two parallel jetties 2,000 feet apart out to the 20-foot curve, the jetties to be 12 feet wide on top at inner end, increasing to 24 feet at outer end, with crest 5 feet above mean low tide, built all of stone. To protect Mustang Island, riprap 18 inches thick was to be laid from high water to bottom of channel, or nearly to bottom, and he recommended that this riprap should be the first work done. Major Ernst considered the jetties would settle 25 per cent. He estimated the cost as follows:

North jetty	$852,500
South jetty	712,000
Revetment	104,000
Total	1,688,500

This project was approved by a Board of Engineers July 19, 1887. The location of the jetties was approved, subject to such change as further study might show to be expedient. (Report Chief of Engineers, 1888, p. 1318.) The Board recommended $500,000 should be appropriated to begin work.

Work was done for the protection of Mustang Island during the next two years as funds became available. The total length of riprap laid was 2,725 feet, extending from high water laid to the bottom, except at the Gulf end, where it was carried to 24 feet depth. For part of the distance the high-water mark was so ill defined and so far from low-water mark that an artificial shore line was developed by building a low wall of riprap and connecting it by a return wall with the high ground in rear. Five thousand four hundred and twenty-eight (5,428) surface square yards of old work were utilized, and 77,000 square yards of new added. (Reports Chief of Engineers, 1888–1889.) This revetment was completed in May, 1889. There not being sufficient funds on hand to warrant beginning the jetties, work at the pass was then suspended.

The Board of Engineers appointed by act of Congress March 2, 1889, to report on the selection of a deep-water harbor on the northwest coast of the Gulf of Mexico, recommended Galveston Harbor as the best adapted for the purpose. The Board, however, stated:

> The Board can not therefore dismiss the subject without commending the harbors at Sabine and Aransas Pass as being worthy of great consideration and vigorous prosecution of the works of improvement to obtain the results which are expected from the completion of the present projects. (Report Chief of Engineers, 1890, p. 1797.)

In view of the smallness of the appropriations that had been made from year to year for carrying on the work at Aransas Pass, and the belief among the people of the probability that any large sums that might be appropriated for harbor work in the State of Texas in the immediate future would be for the benefit of Galveston (report president Aransas Pass Harbor Company), the Aransas Pass Harbor Company was incorporated, and on May 12, 1890, Congress granted certain rights and privileges to this company, and the Government relinquished charge of the work with the fiscal year ending June 30, 1890.

The total appropriations made by Congress were	$581,250.00
Private subscriptions	9,938.93
Total	591,188.93
Expended	550,416.58
	40,772.35

(Report Chief of Engineers, 1890, p. 1811.)

The value of the improvement as turned over to the harbor company is given by Maj. C. J. Allen, Corps of Engineers, as follows:

Old jetty from shore to the wreck of the *Mary*	$68,400.00
Revetment on Mustang Island	163,307.41
Total	231,707.41

(Letter to Chief of Engineers, July 18, 1890.)

The revetment on Mustang Island is, upon examination, found to be still in good condition. It has entirely prevented further erosion. The portion of the old jetty between the wreck of the *Mary* and the shore is mostly covered with sand, and probably has not much deteriorated since 1890.

PROJECTS AND WORK AT ARANSAS PASS BY PRIVATE CORPORATIONS OTHER THAN ARANSAS PASS HARBOR COMPANY.

The first corporation of which the Board has information was called the Aransas Road Company, Pryor Lea, president, chartered under the laws of Texas. The first charter giving rights to build certain roads from the coast to the interior was passed in 1852. The rights and privileges granted were added to by "An act supplemental to incorporate the Aransas Road Company," passed September 1, 1856. Further acts passed in 1858, 1860, and 1866, and finally an act of relief of March 28, 1879, modified somewhat these rights and privileges and extended the time. They have now expired. The rights granted the company were to construct certain roads and bridges on the islands and mainland, to build wharves and terminal facilities, to dredge channels, and to improve Aransas Bar. The company was to be allowed by the State to charge dues and tolls on the wharves, roads, and channels. It was also allowed to levy toll over the bar for ten years after obtaining a channel of 9 feet and for five years more for each additional foot, subject to the provision that if the United States or the State of Texas should undertake to further improve the bar and should refund to the company the cost of the work, this right of collecting toll should cease. No work was ever done on the bar and no tolls collected. The 3-mile levee from the mainland near the city of Aransas Pass to the Corpus Christi channel was built by this company and some work done on the shore adjacent to acquired lands.

The Port Aransas or Port Ropes Company was chartered, under a general law of Texas, about 1889 or 1890. The project was to excavate a channel between Corpus Christi and the Gulf, across Mustang Island, at a point 1 mile south of Shamrock Point, 10 to 12 miles south of Aransas Pass, and where the island is 10,000 feet wide. This channel was to be excavated across private property; it was to be 25 to 28 feet wide and 12 feet deep, with a view to an ultimate excavation of 1,000 feet width and depth of 30 feet. (Letter to Chief of Engineers from Maj.

C. J. Allen, Corps of Engineers, June 30, 1890.) Whatever work was done has disappeared.

The Aransas Pass Improvement Company was incorporated, under the laws of Texas, in 1888. The stock was fixed at $2,000,000. The purpose, as stated in charter, was to construct and secure a deep-water channel across Aransas Pass, to provide harbor and terminal facilities and connections with the mainland, and to charge tolls. The plan, as stated by Mr. U. Lott, president and general manager of the San Antonio and Aransas Pass Railroad, in a letter to Major Ernst, Corps of Engineers, May 10, 1888, was to build two jetties complete as per project of Major Ernst, under the direction of the Engineer Department, to obtain permission of the War Department to begin work at once, and then to frame a bill to be passed by Congress, making an appropriation payable to the company upon completion of work and maintenance for a year. No work on the pass was done by this company.

There have been, in addition, a number of companies formed for work within the bays. The only work of importance that has been done has been the dredging of what is known as the Morris and Cummings Channel. In 1854 an act was passed by the legislature of Texas which authorized the city of Corpus Christi to construct a channel between the bays of Corpus Christi and Aransas, and to levy tolls on craft passing through this channel. The flats separating the two bays had only 2 to 4 feet depth. This authorization was extended by various acts passed from 1856 to 1873, and in addition a donation was made by the State of 16 sections of 640 acres each of land for each mile of canal built, not to exceed 7 miles in all. A shallow, tortuous channel of about 5 feet depth and 7 miles length was excavated, for which the land was given in payment.

The channel not proving sufficient the city entered into a contract with the firm of Morris & Cummings, in accordance with which a channel was excavated between the bays, 8 feet deep at ordinary tides and 100 feet wide at bottom. The channel passes between Harbor Island and the mainland, connecting with the pass around Harbor Island, and then between the latter and St. Joseph Island.

The city of Corpus Christi issued to Morris and Cummings $500,000 of bonds and authorized the collection of tolls. The contract of Morris and Cummings, according to the statement of the attorneys, has a time limitation, but is nonforfeitable. The city can suspend the collection of tolls if at any time the channel becomes of less than the specified width and depth. The channel was opened in May, 1874. It shoaled somewhat between 1877 and 1881, when it was again dug out. It has not at present, from the statement of the pilot, its full dimensions, and no tolls are collected. A steamer drawing 7½ feet can pass through at ordinary high tides.

A company called the Corpus Christi Direct Channel and Dock Company was formed in 1895 to dredge a channel from Corpus Christi Bay to the pass, between Mustang and Harbor islands. The company expects to excavate this channel when the pass shall have been permanently improved.

ARANSAS PASS HARBOR COMPANY.

This company was incorporated on March 22, 1890, under the laws of the State of Texas, for the purpose of digging deep-water channels on the coast of Texas, and also for the purpose of erecting wharves, docks, etc. After incorporation the company was granted, by act of Congress approved May 12, 1890, the right to build and own such structures as it may deem necessary for improving Aransas Pass so as to give a channel across the outer bar with a depth of 20 feet. The State of Texas has by law granted to this company the right to buy from the State certain lands at the rate of $2 per acre. This right to buy, however, is dependent on the company's securing 20 feet of water over Aransas Bar by 1899. The lands allotted to be purchased include parts of Harbor and Mustang islands.

The time for securing the 20-foot depth over the outer bar allowed to the company has been twice extended by Congress, by acts approved January 22, 1894, and January 21, 1896; and this time, as so extended, does not expire until January 21, 1899.

It is understood that for the first work done by this company money was subscribed by persons owning land near by, for which they received stock at par. To continue the work the company raised money by the sale of their bonds and stock. The president of the company in his report, appended hereto and marked "A," says:

> In order to interest capital in the enterprise and to give the bonds of the company a value, the people living in the neighborhood of the proposed work made unconditional donations of land to the company, upon which they placed a value of $400,000. Of this sum, however, $100,000 was not represented by the land itself, but by stock in the Aransas Harbor City and Improvement Company.

After this the bonds were sold at prices ranging from 70 to 30 per cent of their face value, with stock bonuses. It is understood that all the money so raised has now been expended on the work, and the company has been obliged to cease work without finishing in its entirety the project for obtaining 20 feet over the outer bar and without obtaining a greater navigable depth than 8.5 feet.

PLAN OF IMPROVEMENT AS ADOPTED BY THE ARANSAS PASS HARBOR COMPANY.

When the company first took charge of the improvement of the harbor they had no digested plan, as far as the Board has been able to learn, but apparently feared the cutting away of the head of Mustang Island seaward of the riprap protection built by the United States. They devised the method that was used in the construction of the south or Nelson Jetty, began work on the head of Mustang Island, near the east end of the riprap work, and extended it eastward.

The channel deepening as this jetty was extended, the company, as the Board was informed, was encouraged to believe that they might get the hoped-for depth by extending this jetty far enough seaward. When the money received from people living near by, and for which they issued company stock, was exhausted, this work came to an end without accomplishing the hoped-for result. The company then looked abroad for funds and endeavored to interest capitalists. To do this they employed civil engineers to study the problem and prepare a project and estimate for the work. This was done, and work was begun and carried on for some time as advised by the civil engineers.

The plan adopted, by the advice of the consulting engineers, was the construction of a single jetty, which is thus described in a prospectus of the company:

> This structure consists of a line of works detached from the shore, every portion of which has its special function to perform, and which is intended to utilize and cooperate with the work which has already been done. The outer concavity is constructed on a curve whose radius is that which now produces and maintains depths of from 30 to 40 feet when protected from wave action and littoral drift, as in the concavity inside of the pass; the middle or convex curve is designed to concentrate

the ebb currents and increase their surface slope over the bar, while its opposite concave face will collect sand and reinforce that portion of the work; the salient is intended to divide the flood currents during the first quarter and aid the discharge of the later ebb currents, while the funnel formed by the breakwater and the shore of St. Joseph Island will aid the influx of flood tide and increase the efflux passing out over the lower portion of the bar, thus changing the condition of equilibrium in favor of ebb scour.

However, the form of jetty was modified before work began, and the actual structure built is described as follows. (See Exhibit C):

In plan it will differ from the usual form of jetty or breakwater, being detached from the shore and located on the bar to the "windward" of the channel. Its axis will be curved (compound and reverse), to produce reactions similar to those found in the concavities of streams, and having radii sufficient to maintain channels of the requisite depths, as revealed by existing curves and their resulting depths of over 30 feet, now found inside the bar. It is designed to fulfill the fundamental conditions of (*a*) arresting the littoral drift; (*b*) admitting the full tidal prism to the interior lagoons; (*c*) controlling the ebb currents and producing a reaction across the bar; (*d*) changing the conditions of equilibrium of flood and ebb currents in favor of the latter, and (*e*) of affording aids to navigation by a structure of only half the length of the usual convergent or parallel jetties in pairs.

The work will be executed in two parts. The first will consist of 1,250 feet of completed breakwater and 2,500 feet of foundation extension. The second of 5,950 feet of completed breakwater and 250 feet of foundation extension. It is to be covered with a substantial apron of heavy blocks, weighing from 2 to 5 tons, carefully placed so as to produce a permanent and substantial structure.

The construction of the proposed breakwater as designed will unquestionably result in securing navigable depths over the bar of 15 feet for the first part of the work and 20 feet for the second.

WORK DONE AT PASS BY ARANSAS PASS HARBOR COMPANY.

The work done by the harbor company consists of two jetties and certain auxiliary work in the channel. The first jetty, called south or Nelson Jetty, was built about 1892. It is built on Mustang Island, starting near the company's wharf, on a curve concave to the channel for a distance of about 1,800 feet, as measured on the charts. It is from 600 to 1,000 feet nearer the channel than the line of the old Government jetty. It consisted of a row of light cylindrical wooden caissons, 7 feet in diameter, filled with sand and stone and riprapped to a certain extent.

The second and principal jetty, called the north jetty, was built between August, 1895, and September, 1896. It was designed by the consulting engineers of the company, Prof. Lewis M. Haupt and Mr. H. C. Ripley. It was intended to develop a depth of 20 feet. (Letter from Messrs. Lewis M. Haupt and H. C. Ripley, June 12, 1895, appended, Exhibit C.) This plan contemplated a jetty about 6,200 feet long, located as shown on map appended (No. 2), and consisting of:

First. A foundation of brush not to exceed 2 feet thick, covered with stone 3 feet thick, and with widths as follows: First, 2,000 feet, 40 feet wide; next, 1,700 feet, 50 feet wide, and next, 2,500 feet, 60 feet wide.

Second. A superstructure having a top width of 10 feet at an elevation of 3 feet above the plane of mean low tide and with side slopes of 1½ horizontal to 1 vertical. (Letter from consulting engineers, June 12, 1895, Exhibit C, and letter from Mr. W. D. Jenkins, chief engineer of harbor company, September 19, 1896, Exhibit D.)

The jetty, as laid out on map, starts about 1,500 feet out from St. Joseph Island and follows seaward the general direction of the pass on a curve 2,000 feet in length and with a radius of 3,000 feet, convex toward channel side; then a reverse curve 2,200 feet long with radius of 6,000 feet, compounded with a curve 2,000 feet long with radius of 4,000 feet. This compound curve is concave toward the channel. The depths on the line of the jetty were, before commencing work, generally from 9 to 11 feet, with an extreme depth of 17.5 feet at outer end and shoaling at inner end to 5 or 6 feet.

The estimate of contractor to construct the complete work was $285,000. (Letter from Charles Clarke & Co., June 8, 1895, Exhibit E.)

The harbor company decided not to build the jetty complete at once, but to build a certain definite portion. It was stated by the consulting engineers that the construction of this definite portion would unquestionably result in securing navigable depths over the bar of 15 feet. (Exhibit C.)

The firm of Charles Clarke & Co., of Galveston, Tex., made, under date of July 3, 1895, a contract with Mr. Brewster Cameron, of Philadelphia (Exhibit F), by which they agreed to construct for a lump sum of $145,000 a breakwater all rock, or rock with a light brush foundation, as follows (see map 2): Starting from a point F on the 15-foot curve, about 450 feet inside the outer end of jetty as designed, and building, first, 1,000 feet foundation from F to B; then 1,250 feet completed breakwater B to C; then 1,500 feet foundation C to D; total length, 3,750 feet, ending at point where reverse curve begins, 2,000 feet outside of inner end, as designed. This is the definite portion which, it was stated, would secure a navigable depth of 15 feet. This work was begun July 24, 1895, and finished January 22, 1896.

This jetty was constructed (letter of W. D. Jenkins, January 28, 1896) by laying mattresses 100 feet long and 40 to 50 feet wide, made of fascines and poles bound with tarred yarn; over this was spread the rock foundation 3 feet thick, 50 feet wide for 1,750 feet from inner end, and 60 feet wide for the remaining 2,000 feet. The stone was a sandstone of good quality, average weight of the greater part 142½ pounds per cubic foot, and of sizes from 100 to 1,000 pounds, filled in with quarry refuse. On this foundation was placed from B to C (1,250 feet) a core built up to low water of similar stone covered with cap and face stone weighing 2 to 10 tons, so as to give a top width of 10 feet and slopes of 1½ and 2 horizontal to 1 vertical. The amount of stone placed was 35,200 yards, or about 36,000 tons, a loose yard being by measurement a little over a ton. The 15 feet depth expected was not obtained by this jetty, and the harbor company decided to extend the work.

Written contracts were made between the harbor company and Charles Clarke & Co., dated January 6, 1896, and March 2, 1896, and a verbal extension, about July 20, 1896, in accordance with which the jetty was brought to its present state of partial completion. The foundation is laid from outer end F to inner end E, a distance of 5,750 feet, 60 feet wide at outer end and 25 feet at extreme inner end, though generally not less than 40 feet. When this inner end was laid there was but 3 or 4 feet depth of water at that point. On this foundation from B (a point 1,000 feet within F) to C, 1,250 feet, the jetty was built complete; thence to D, 1,500 feet, the core was put in and the capping partially placed; thence to E, 2,000 feet, a portion of the core was laid. The superstructure of the jetty has settled and been washed down somewhat. The material placed under these latter contracts and agreement was 2,000 linear feet of mattress and 21,200 cubic yards of stone.

This jetty failed to give any considerable permanent increase in depth. On September 12, 1896, a contract was made with Mr. C. P. Goodyear, in accordance with which payments were to be made conditional on securing certain results. The contractor was required to obtain within eighteen months and maintain for a year a channel not less than 150 feet wide at the bottom and not less than 20 feet deep at mean low tide for full width of channel. The contract stated that a dredged or blasted channel would not be a compliance with its terms, but that the contractor should complete the present uncompleted breakwater in such manner as to make it effective to maintain a channel and build such other spurs, jetties, and breakwaters as might, in his opinion, be necessary to secure and maintain the channel. The original project of a single jetty was thus apparently given up. The harbor company agreed to "pay to the said contractor the sum of five hundred thousand dollars, of which sum four hundred thousand dollars is to be in cash and one hundred thousand dollars in the first-mortgage bonds of said harbor company at their face par value." (Exhibit G.)

On March 11, 1897, a supplemental agreement was made by which, at the request of the contractor, $20,000 of bonds were paid to the contractor, and the company further agreed to pay $10,000 of such bonds when a depth of 10 feet was obtained in channel and not less than 1,000 tons of rock were placed in northern breakwater, or in lieu 200 linear feet of a south wall built extending from Mustang Island to the wreck of the *Mary*, and the same amount for each additional foot depth up to 20 feet and equal additional amount placed in breakwater or built in south sea wall.

The contractor did work to the estimated extent of $15,000, blasting the channel with dynamite and placing sand bags near the Nelson Jetty to accumulate sand.

The amount of dynamite used was 23,350 pounds, of which 13,000 pounds were used to blow out about 500 feet in length of the old Government jetty, which crossed the channel at an angle of 45 degrees, with depths of 8 to 14 feet, and was considered as presenting an obstruction to further deepening. It is not certain that this jetty was all removed. The contract has been annulled and there is none now in force.

CONDITION OF WORKS.

The south or Nelson jetty has been greatly damaged by storms, teredos, etc. It is in a very dilapidated condition and a large part gone.

The north jetty has, as stated, never been completed as designed. The material placed in the jetty, according to letter of chief engineer of company, Mr. W. D. Jenkins, September 19, 1896 (Exhibit D), is about 25,500 square yards of mattress 2 feet thick, or approximately 17,000 cubic yards, and 56,400 cubic yards, or 57,700 tons, of stone. Of the latter, 9,200 cubic yards are capping stone, and 47,200 cubic yards are foundation and core riprap.

An examination of the jetty in November, 1897, shows its condition to be as follows: Starting at E, the inner end of jetty, for 2,000 feet, to D, the core barely comes, at irregular points, to surface of low water; there are several gaps, one of which has a width of some 200 feet and a depth of at least 8 feet. From D, for 350 feet, the jetty has a full section; thence to B, 2,350 feet, the general level is slightly above the water surface, with the capping stones projecting irregularly from 1 to 3 feet higher. A large part of this (from C to B, 1,250 feet) was originally built to full section, but has been washed down by the storms. From B to the end, 1,000 feet, the foundation only has been laid; the depths over this foundation are from 8 to 14 feet at low water. The sides of the jetty are in many places covered with sand. The stone used in the jetty seems in good condition.

The amount of material needed to complete the jetty as projected—

that is to say—extend it 450 feet seaward, and build up the remainder to proper cross section, is, from same letter of company's engineer, 450 feet of mattress work 60 feet wide and 2 feet thick, 29,000 cubic yards riprap stone, and 24,000 cubic yards of block stone.

EFFECT OF WORKS CONSTRUCTED BY HARBOR COMPANY.

The depth that can be carried over the bar has not as yet been materially, if at all, increased by the works constructed by the harbor company. The depths from 1851 to 1891 varied from 7 to 10.5 feet, as shown on maps of the Coast and Geodetic Survey and of the United States Engineer Department. The charts of the company's soundings during the period from 1895 to 1897 give generally 8 to 9½ feet. A chart of October, 1895, gives an irregular line over the bar of about 13 feet depth and one of February, 1896, gives 10 to 11 feet. At time of examination of the Board in July, 1897, it was 8.8 feet, and in November, 1897, 8.5 feet. The depths and contour lines are shown on appended charts and maps.

Since the building of the jetty the position of the channel seems to have become more constant, and, as shown by the following table, the width across the bar to have lessened.

Distances across bar between contour lines.

Date.	20 feet.	15 feet.	12 feet.	10 feet.	Authority.
	Feet.	*Feet.*	*Feet.*	*Feet.*	
1875	5, 400	....	2, 812	2, 500	A.
1878	6, 000	....	3, 593	2, 800	A.
1887	4, 700	....	2, 650	2, 300	B.
1891	4, 800	3, 750	2, 500	2, 000	C.
February, 1895	5, 800	3, 650	2, 050	(*)	D.
October 21, 1895	4, 050	2, 200	(*)	(*)	E.
December 28, 1895	3, 600	2, 450	(*)	(*)	E.
February 21, 1896	3, 900	2, 000	1, 600	(*)	E.
July 8, 1896	4, 650	3, 100	2, 400	1, 500	E.
August 28, 1896	5, 000	3, 250	2, 400	1, 800	E.
December 10, 1896	4, 300	2, 600	1, 900	1, 200	E.
February 2, 1897	4, 450	2, 200	1, 000	850	E.
June 8, 1897	4, 650	2, 400	1, 000	750	E.
November, 1897	4, 200	2, 750	1, 400	800	F.

* Irregular scattered contours.
A. Report Chief of Engineers, 1888, page 1315.
B. Map of United States Engineer Office, 1887.
C. Coast and Geodetic Survey, 1891.
D. Ripley survey. See map attached.
E. Charts of soundings, furnished by harbor company.
F. Chart of soundings, taken under direction of Board of Engineers in November, 1897.

In several instances the soundings were not taken in sufficient number to locate the contours absolutely.

The distances across the bar on the charts are measured from the inside contour to the corresponding outside one beyond the end of the jetty. There is on some charts a deep narrow trench running along side of the jetty, which would give considerably less distance, but this would not indicate correctly the real changes on the bar.

Examining this table there seems to be a lessening of distance between contours since the building of the north jetty. The outside slope has changed but little, though varying somewhat from time to time. The change has been in the advance of the inner contours. The retrograde movement between February and July, 1896, as appears in the table, was due to a strong ebb current passing between the jetty and St.

Joseph Island. This was stopped in part by building up the jetty at the inner end.

It was thought by the company's engineers and by the contractor, Mr. Goodyear, that the old Government jetty acted as a dam to prevent further deepening. This jetty was, therefore, between December, 1896, and May, 1897, blasted out over a length of about 500 feet. This blasting was apparently followed by an advance of the inside contours between December, 1896, and February, 1897, but since then the distance between contours has not much altered. The channel used by pilots now passes directly over the north jetty a few hundred feet from outside end.

There does not seem any probability that the jetty, as now constructed, will of itself secure and maintain any considerable increase of depth in a navigable channel of proper width.

COST OF WORKS CONSTRUCTED BY THE HARBOR COMPANY.

The expenditure as given in the report of the president of the company (Exhibit A[4]) is, with interest up to January 1, 1898:

Nelson (or south) Jetty	$107,469.74
North jetty	294,084.44
	401,554.18

In addition, $123,000 were expended in payment of taxes, purchase and construction of terminal railways, protection of its properties, payments of debts, purchase of part of Harbor Island, and incidental expenses. The amount stated in report as actually paid out for building the Nelson Jetty prior to January 1, 1895, was $53,834.17. The remaining amount comprises interest, salaries of officers, and debts partially paid. Whether these debts were for engineering construction or not is not stated.

On the north jetty the amount actually paid the contractors is given in report of the president, in round numbers, as $235,000. The exact amount, from examination of contracts, would be $224,926.16. Adding the engineering salaries and expenses, $14,943.71, as given in report of the president, would bring the sum to about $240,000 or $250,000.

The material in the structure, as before stated, is:

	Cubic yards.
Riprap and core stone	47,246
Capping stone	9,183
Mattress work, approximate	17,000

In the last contract made by the Government for the construction of the jetty at Aransas Pass, known as the Government jetty (contract with A. M. Shannon & Co., August 27, 1884; Report Chief of Engineers, 1885, p. 1466), the prices were $2.70 per cubic yard for brush mattress and $4.40 per cubic yard for stone. The jetty was formed of alternate layers of mattress work and stone. Applying these prices to the company's work would give $45,900 for mattress work and $248,300 for the stone, or $294,200 in all as the cost of the jetty.

The jetties now building at Galveston, Tex., are made all of stone, with a sandstone core and granite capping. The contract price is $2.35 per ton for the sandstone and $4 to $4.40 per ton for the granite. (Report Chief of Engineers, 1891, p. 1879.) The same contractor bid from $2.50 to $2.80 per ton for sandstone blocks. For the stone used at Aransas Pass this would give about $2.50 per yard for the core stone and $2.80 for the capping. Taking the cost of the mattress work as above, would make a total of about $190,000 as the cost of constructing the jetty. These figures do not include office expenses.

Two hundred and fifty thousand dollars would, therefore, seem a fair estimate of what it would have cost the United States to have built this jetty, but according to the projects that have been approved for the improvement of this pass it would never have been built by the United States.

To complete the jetty the quantities as above stated are:

Mattress work, 60 feet wide and 2 feet thick	linear feet..	450
Riprap and core stone	cubic yards..	29,000
Capping stone	do....	24,000

The cost of completion according to contract price of second contract with Charles Clarke & Co., of $16.25 per linear foot of apron extension, which includes 3 feet of stone, and $4 per yard for stone on this foundation, would amount to $205,000. These figures are taken from the only one of the contracts between Charles Clarke & Co. and the harbor company where a price for mattress work is given, and are for a mattress narrower than would be required to complete the jetty, and laid in much shallower water. The cost of completion with all stone, according to prices bid for Galveston Harbor jetty, would be, approximately, $145,000. If granite capping is used, the cost would be about $250,000.

VALUE TO THE GOVERNMENT OF THE WORKS OF THE ARANSAS PASS HARBOR COMPANY FOR THE IMPROVEMENT OF ARANSAS PASS, TEXAS.

If the General Government does not intend to improve Aransas Pass, then of course there can be no value to it of the works built and partially built for the purpose of deepening the channel across this bar, which have produced no greater depths than were found before these works were constructed.

The Board, however, is thoroughly satisfied that the importance of this harbor, as shown by many reports heretofore made, is so great that the General Government will certainly undertake and carry to completion the work necessary for improving Aransas Pass.

Before any work was done by the company a project for the improvement of the pass was proposed with a view of obtaining a depth over the bar of 20 feet at mean low water. This project dealt with the problem as it was at that time, 1887, and there was no material change in the conditions when the company began work, except that the head of Mustang Island had been revetted. This project was devised by Maj. O. H. Ernst, Corps of Engineers, and may be found in Report of the Chief of Engineers for 1888, pages 1312–1318. This project proposed the use of two jetties, one springing from Mustang Island and the other from St. Joseph Island. Major Ernst does not give in his plan estimates of material for the jetties, but gives a general estimate of their cost, which would be materially reduced at present prices. This general project of two parallel jetties, one from St. Joseph and the other from Mustang Island, received the indorsement of The Board of Engineers and the Chief of Engineers in 1887, and of the Board on a Deep Harbor for the Northwest Coast of the Gulf of Mexico in 1889. (See Reports Chief of Engineers, of 1888, p. 1319, and of 1890, pp. 1794, 1797.)

This Board believes that the plan above referred to was the proper method of improving this pass to its full capacity. The jetties run approximately at right angles to the bar and allow of extensions hereafter if necessary. The exact direction of the jetties can be modified during the progress of the work so as to make the entrance as easy as possible. They protect the channel from sand drifting into it from either the north or the south, and vessels entering between them are to a great extent protected from cross currents and waves while required to keep in a comparatively narrow channel. As the channel is protected from drifting sand on both sides, it is comparatively easy to obtain and keep open a deep channel by occasional dredging. The entrance can be kept at a width sufficient to provide for the free admission of the flood tide, without diminishing the available space for handling light-draft sailing vessels.

The Aransas Pass Harbor Company, instead of carrying out the Government plan, adopted one entirely in conflict with it, and prosecuted with vigor the portion of it which their engineers said would produce 15 feet of water, completing it in six months. As the expected results were not obtained, they did some 50 per cent more work without getting the 15 feet. After having thus done about three-fourths of the work necessary, according to their engineers, to get 20 feet, and at least 50 per cent more than required to get 15 feet, without securing any practical permanent improvement of the channel, the company appear to have lost faith in their own plans, as they then made a contract for securing a 20-foot channel at a price fully 60 per cent greater than the entire original cost of their reverse curve breakwater as estimated and bid for by the contractor, who had now completed more than half of it. Under this new contract the contractor could build what jetties he pleased, and was to be paid nothing until he obtained and secured for a year the desired 20 feet. This contract was soon abandoned, as has been heretofore stated. It is possible that the company may do some dredging in the future, which will necessarily be of a temporary nature, if of sufficient width, as there is no southern jetty to protect the channel from the sand coming from the south.

In the future improvement of this pass it is impossible to ignore the existing structures. The reverse curve breakwater built by the Aransas Pass Harbor Company is so located as to prevent carrying out the Government project for this improvement except by removing the breakwater, as it diagonally crosses the space between the proposed jetties. (See Map No. 2.) Its removal would be so costly that it appears probable that it will be found advisable to take up only the outer portion of the present work and utilize the remainder as a part of a northern jetty, in connection with a southern one. The width between these jetties would be much less than advisable if the present breakwater were out of the way—in fact, not more than one-half of the width proposed by Major Ernst—and therefore the objectionable opening between the present curved breakwater and St. Joseph Island might have to be left to prevent cutting off the tidal inflow. It is possible, too, that the remains of the Nelson Jetty, or a part of it, may have to be removed in order to let a portion of Mustang Island wash away rapidly, so as to get more width between it and the curved breakwater.

While the improvement of this pass has been greatly complicated by the works constructed by the Aransas Pass Harbor Company, and the pass will never be as good as it would have been had these works never been constructed, still this Board believes that with a careful study of the problem a plan of improvement can be devised that will give for a reasonable cost quite a good entrance in which a channel of navigable width with 20-foot depth at mean low water can be maintained by the aid of inexpensive dredging. Such a plan would doubtless remove a small part of the curved breakwater and utilize the balance. It would cost less than the approved Government plan, but it would not be so good. Still the harbor is such an important one that in spite of the injury to it by this work the Board is of the opinion that it is worthy of immediate improvement.

In consideration of all these facts the Board is of the opinion that the value to the Government of the works of the Aransas Pass Harbor Company for the improvement of Aransas Pass, Tex., is nothing.

CONCLUSIONS OF THE BOARD.

After a personal examination of Aransas Pass and the works of the Aransas Pass Harbor Company, and after consideration of all the information that they could obtain, the Board has arrived at the following conclusions:

First. The depth of water on the bar at the time of their examination.—The personal examination was made July 20, 1897, when a depth of 8.8 feet at mean low water was found. By soundings made under the personal supervision of one member of the Board in November, 1897, the depth found was 8.5 feet, when reduced to mean low water.

Second. The character of the work done and the cost of the same.—The work may be divided into three parts:

(1) *The building of the south or Nelson Jetty.*—This work was temporary in its character and cheaply done, and it is now quite dilapidated. It cost $53,834.17. (2) *The partial building of the north jetty.*—This work is well done and the material used is of good quality. The cross section of this jetty might with advantage have been made larger. The cost of this jetty, so far, has been about $250,000. (3) *Blasting with dynamite and building sand catches near eastern end of the south or Nelson Jetty.*—The character of this work was temporary, and if it had any effect in permanently deepening the channel this effect has been very slight. The cost to the company was $2,250 and twenty $1,000 bonds of the company.

Third. The character and cost of any unfinished work contracted to be done by said company.—There is no work now contracted for and unfinished.

Fourth. The value to the Government of all work done or contracted to be done by said company for the purpose of deepening said channel or removing said bar.—The Board is of the opinion that the work done by the company for the purpose of deepening the channel or removing the bar at Aransas Pass, Texas, is of no value to the Government. There is no work contracted to be done for this improvement.

Fifth. Such other information as they (the Board) may deem essential to be known to Congress in making provision for the purchase of said works by the United States Government.—The Aransas Pass Harbor Company was granted certain rights and privileges by act of Congress of May 12, 1890, provided they increased the depth of water over the bar to 20 feet by May 12, 1895. The time for getting this depth of water and retaining their rights and privileges was extended twice by Congress, by acts of May 22, 1894, and January 21, 1896, until January 21, 1899. In both of these later acts the privilege of repealing the laws has been reserved by Congress.

To carry on the work of improvement the company raised money by sale of their bonds and stock. The value of these securities depended on the franchises and donated lands owned by the Aransas Pass Harbor Company and allied companies, and upon securing a 15 or 20 foot channel over the bar, and not on the structures built for the improvement of said bar. While the value of these securities depends on the deepening of the Aransas Pass channel, it is in nowise dependent on whether this deepening is secured by the harbor company or by the General Government, except that the company's right to purchase from the State of Texas certain lands depends on the company gaining the depth of water by January, 1899. It will thus be seen that if the General Government takes up and carries to completion the proposed improvement of Aransas Pass the securities of the harbor company will be made practically as valuable as they would have been if the company had carried on the works to completion at their own expense.

The Board desires to express its thanks to the officers of the harbor company for their kindness and assistance, especially to Mr. W. Dunbar Jenkins, chief engineer of the company. Mr. Jenkins has been unremitting in assisting the Board in every way possible.

Appended hereto is a list of the papers, maps, etc., which accompany this report.

Respectfully submitted.

HENRY M. ROBERT,
Colonel, Corps of Engineers.
WM. T. ROSSELL,
Major, Corps of Engineers.
JOHN BIDDLE,
Captain, Corps of Engineers.

The SECRETARY OF WAR.
(Through Brig. Gen. John M. Wilson, Chief of Engineers, U. S. A.)

LIST OF PAPERS, MAPS, ETC., TO ACCOMPANY REPORT OF BOARD ON ARANSAS PASS, TEXAS.

Exhibit A.—Report of president of Aransas Pass Harbor Company, with four subexhibits.
Exhibit B.—Summary of commercial statistics from 1879 to 1890, compiled from Reports of Chief of Engineers.
Exhibit C.—Letter from consulting engineer of Aransas Pass Harbor Company, giving plan of jetty.
Exhibit D.—Letter from chief engineer of harbor company, giving quantity of material in jetty and necessary to complete jetty.
Exhibit E.—Estimate of contractor to build jetty.
Exhibit F.—Contracts of Charles Clarke & Co.
Exhibit G.—Contracts of C. P. Goodyear.
Map 1.—Aransas Pass, Texas, and adjoining bays.
Map 2.—Survey of Aransas Pass by consulting engineer of Aransas Pass Harbor Company, 1895.
Map 3.—Charts of soundings on Aransas Bar.
Map 4.—Charts of soundings on Aransas Bar.
Map 5.—Charts of soundings on Aransas Bar under direction of Board of Engineers.
Map 6.—Aransas Pass, Coast and Geodetic Survey, 1854.
Map 7.—Aransas Pass, Coast and Geodetic Survey, 1868.
Map 8.—Aransas Pass, Coast and Geodetic Survey, 1891.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 2, 1897.

Respectfully forwarded to the Secretary of War.

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Exhibit A.

REPORT OF PRESIDENT ARANSAS PASS HARBOR COMPANY.

San Antonio, Tex., *September 7, 1896.*

The Aransas Pass Harbor Company was incorporated on the 22d day of March, 1890, under a general law of the State of Texas authorizing the incorporation of companies for the purpose of digging deep-water channels on the coast of Texas, and also for the purpose of erecting wharves, docks, etc.

The purposes of the corporation, as expressed in its charter, are for the constructing, owning, and operating deep-water channels from the waters of the Gulf of Mexico along and across Aransas Pass, and along and across Nueces and Aransas bays, and the channels and inlets thereof, and constructing, owning, and operating docks, wharves, entrances, moorings, approaches, and ways into, on, and across said pass, bars, and channels and the surrounding and neighboring mainlands and islands, and for the construction, use, and enjoyment of such warehouses, stores, and sheds as may be necessary for receiving and discharging freights, goods, wares, and merchandise, and the proper protection and preservation thereof. And to provide facilities for vessels and boats entering said Aransas Pass Harbor for dockage, and receiving and discharging cargoes and passengers, and to charge and collect tolls and wharfage therefor.

The principal office of the corporation is San Antonio, Bexar County, Tex. The term of the corporation is fifty years, and the amount of its capital stock $2,000,000, divided into 20,000 shares of $100 each. A copy of this charter is attached, and marked "Exhibit A 1." The act under which it is incorporated confers upon it the following powers:

Generally: To construct, own, and operate deep-water channels from the waters of the Gulf of Mexico along and across any of the bays on the coast of Texas to the mainland, for the purposes of navigation and transportation, and to construct, own, and operate docks on the coast of Texas for the protection and accommodation of ships, boats, and all kinds of vessels for navigation and their cargoes.

As a channel company: (1) To cause such examination and survey for its proposed channel to be made as may be necessary to the selection of the most advantageous route for such purpose by its officers, agents, or servants to enter upon any of the waters of such bays, and upon any of the lands of this State or of any person.

(2) To take and hold such voluntary grant of real estate and other property as shall be made to it to aid in the construction and maintenance of its deep-water channel and works pertinent thereto.

(3) To construct its channel across, along, through, or upon any of the waters of the bays within the jurisdiction of this State, and so far into the mainland as may be necessary to reach a place for its docks that will afford security from cyclones, storms, swells, and tidal waves, with such depth as may suit its convenience and the wants of navigation—not less than 10 feet, and a width of not less than 40 feet.

(4) To furnish to vessels and boats, adapted to the purpose, facilities for navigating in and along the entire length of its channels, and to charge and collect a toll therefor, to be prescribed and established by its by-laws, not to exceed 1 per cent per barrel bulk of the capacity of each vessel for each mile of the length of its channel used by the vessel going either way.

(5) To borrow such sums of money as may be necessary for constructing, finishing, or operating its channel, and to issue and dispose of its bonds for any amount so borrowed, and to mortgage its corporate property and franchises to secure the payment of any debt contracted for the purposes aforesaid: *Provided*, That damages for any property appropriated by such corporation shall be assessed and paid for as is provided for in case of railroads.

(6) To enter upon and condemn and appropriate any lands of any person or corporation that may be necessary for the uses and purposes of such channel corporation, the damages of any property thus appropriated to be assessed and paid for in the same manner as provided by law in the case of railroads: *Provided*, That no damages shall be assessed against or paid by it for any portion of the route of its channel embraced within and covered by the waters of any bay on the coast of this State, nor for any portion of any island belonging to the State, that may be requisite and necessary to the construction and successful operation of its channel: *And provided further*, that its right of way shall be the actual width of its channel, and not more than 300 feet in width on each side of it: *Provided*, That when the land sought to be condemned under this act is arable land, such right

of way shall not extend farther than 150 feet on each side from the edge or boundary of said channel.

(7) To construct, own, and operate its channel so far into the waters of the Gulf of Mexico as may be necessary to obtain an adequate depth of water at its Gulf entrance to facilitate the ingress and egress of such vessels as may navigate the same, in so far as this State may have the power to grant such right, and which shall be in subordination to that of the Government of the United States in as far as that Government has the constitutional power to control the same.

As a wharf company: (1) To purchase, take, and hold such land or real estate as shall be necessary for the construction of its docks, approaches, entrances, moorings, and ways, and the construction, use, and enjoyment of such warehouses, stores, and sheds as may be necessary to the receiving and discharging of freights, goods, wares, and merchandise, and the proper protection and preservation thereof: *Provided*, That no such dock corporation shall ever have the right or power to take or condemn to its own use any private proverty without the free consent of the owner thereof, expressed by a sufficient deed in writing.

(2) To construct its dock or docks in such manner and of such size and depth as it may deem meet and proper to suit the convenience of such vessels as may see fit to use and occupy the same, and to collect from the vessels using same, or from their masters, owners, or consignees, such sum or sums for the use thereof as may be authorized by its by-laws and agreed to by such masters, owners, or consignees.

(3) To borrow such sums of money as may be necessary for constructing, completing, or operating its dock or docks, and to issue and dispose of its bonds for such amount so borrowed, and to mortgage its corporate property and franchises to secure the payment of any debt contracted for the purposes aforesaid.

(4) To purchase, take, and hold such land or real estate as shall be necessary for the construction, maintenance, and operation of its harbor approaches, entrances, and ways thereto, and the construction of wharves, piers, and warehouses.

(5) To construct, own, and maintain its harbor by building piers and breakwaters so far into the Gulf as may be necessary to obtain sufficient depth of water to facilitate the ingress and egress and the safety while in port of such vessels as may enter the same. in so far only as the State may have the power to grant such right, which, however, shall be exercised subject and in subordination to the Government of the United States in so far as it may have constitutional power to control the same.

(6) To provide facilities for vessels and boats entering its harbor for anchorage, receiving and discharging cargoes and passengers, and to charge and collect fair and reasonable tolls and wharfage therefor, to be prescribed by its by-laws.

(7) To borrow money in such amounts and on such terms as may be necessary for constructing and finishing or operating its harbor or piers, and to issue and dispose of its bonds for any amount so borrowed, and to mortgage its corporate franchises to secure the payment of any debt contracted for the purposes aforesaid.

(8) For each and every charter, amendment, or supplement thereto taken out under this chapter, a fee of $100 shall be paid to the secretary of state, for the use and benefit of the State, which shall be paid when the charter, amendment, or supplement thereto is filed for record.

(9) All rates, tolls, or charges made by any corporation formed under the provisions of this act shall be subject to the right of the legislature, from time to time, to alter, revise, change, or amend.

Under an act of the legislature of Texas, passed at the session of 1897, the further power is conferred on the company to purchase from the State the whole of Harbor Island, except the quarantine grounds and light-house grounds, at $2 per acre, payable in installments. Also, to purchase shallow bays, coves, and inlets within one-half mile of any channel said company may dig. This act requires the company to obtain a 20-foot channel across the bar by January 1, 1899, and maintain it two years thereafter, in order to obtain the benefit of its provisions, and provides that channels dug shall be free. A copy of this act is attached and marked "Exhibit A 2."

On the 12th day of May, 1890, an act of Congress was passed authorizing the company to construct, own, and operate such permanent and sufficient jetties and breakwaters and such additional works as are necessary to create and permanently maintain a navigable channel across the outer bar obstructing the entrance to Aransas Pass Harbor, and so far into the bays and navigable waters as might be necessary to reach a place that would afford ample dockage and protection from storms, etc., and for that purpose the company was authorized to construct in the Gulf of Mexico, and in and across the bays and navigable waters adjacent thereto, such walls, jetties, dikes, levees, and other structures, and employ such boats, rafts, bridges, and appliances as they might deem necessary in the prosecution of said work. The time within which its benefits could be secured was limited by the terms of the act, and it was further stipulated therein that at any time after the improvements and works had been completed, and a depth of 20 feet obtained, the United States should have the right to pay to the company or its assigns, successors, or legal representatives the value of the work constructed under said act or under or by virtue of any authority granted by the State of Texas, and that on such payment being made by the United States all right to said work on the part of said parties should cease; but that nothing in the act should be so construed as to compel the Government to take possession of and pay for said work unless so desired. It was stipulated in the act that the navigation of the channel to be constructed should be free. A copy of this act is attached and marked "Exhibit A 3."

By subsequent acts of Congress the time has been extended in which the company could obtain the benefit of the provisions of the first act, but the requirement that a certain amount of money should be expended by the company, as provided by the first act, is not carried into the subsequent acts.

There is also submitted to you in connection with this report copies of contracts made for the construction of the works at the pass up to the present time. Some of the contracts with Clarke & Co. were in parol, and copies can not, therefore, be furnished. Copies of reports of company's engineers are also furnished you with this.

At the time of the formation of the company it was believed that no Congressional appropriation could be secured for any of the Texas ports except that of Galveston, and that the only means whereby the port of Aransas could be developed and the deep-water channel obtained was through private capital. The original incorporators of the company were connected officially or semiofficially with the San Antonio and Aransas Pass Railway Company, and it was expected that a certain portion of the assets of the said company would be devoted to the work of securing deep water through the active operation of the Aransas Pass Harbor Company. The railway company, however, became involved in financial difficulties, and it was unable to provide for the carrying on of the work, and the Aransas Pass Harbor Company then succeeded in disposing of a certain amount of its stock at par, raising thereby a sum of money which was utilized in the construction of what is commonly known as the Nelson Jetty, extending from Mustang Island outward, and in other expenses of the company.

This fund having proved insufficient, the company found itself in a condition where it was unable to further prosecute the work without the aid of outside capital. It had no bonded debt and its unsold stock had no value. By diligent work it succeeded in getting some outside capitalists interested to the extent of advancing the sum of $145,000, which, it was believed, would be sufficient to complete a sufficient portion of the projected jetty to procure a channel 15 feet deep across the bar, and, with this channel obtained, it was thought that bonds of the company could be issued and sold at such a figure as to insure the completion of the jetty as originally planned and the doing of all work necessary to secure a channel of 20 feet across the bar, to maintain same, and to develop the port by the erection of wharves, etc.

In order to raise the $145,000, $250,000 first-mortgage bonds of the company were issued and negotiated; some additional money to pay off some existing obligations and carry the company along was also raised by sale of said bonds. The completion of the portion of the breakwater for which the $145,000 was to be spent materially deepened the channel, but did not secure the depth of 15 feet, and it was then determined to issue bonds of the company to the extent of $1,000,000 (the holders of the $250,000 issue agreeing to take bonds of the new issue in lieu of those held by them), and to utilize these bonds to raise money to further prosecute the work at the pass. Since then, at different times, bonds of this $1,000,000 issue have been sold, and the larger part of the money raised employed to prosecute the work.

In the meantime the company entered into a contract with Col. C. P. Goodyear, of Brunswick, Ga., by the terms of which he agreed to secure for the company a channel 20 feet deep across the bar, and maintain the same for a year, and to receive no compensation until the channel had been obtained and maintained. Owing to some financial difficulties, Colonel Goodyear was unable to carry the work to completion, and this contract is now abrogated.

I herewith attach statement of all moneys spent in the work at the pass, including engineering expenses, office expenses, etc., and mark same "Exhibit A 4." You will note from said exhibit that when the work was begun on the north jetty, under the contract made to build and maintain a portion of same for $145,000, there was still money due for work previously done by the company, and payment has been made, as shown by said exhibit, of these amounts, and the same charged to account of the Nelson Jetty, as said indebtedness was incurred while said jetty was being constructed, and was a part of the expenses of said construction.

In order to interest capital in the enterprise and to give to bonds of the company a value, the people living in the neighborhood of the proposed work made unconditional donations of land to the company, upon which they placed a value of $400,000. Of this sum, however, $100,000 was not represented by the land itself, but by stock in the Aransas Harbor City and Improvement Company.

COMMERCIAL IMPORTANCE OF ARANSAS HARBOR.

As each member of your Board has visited Aransas Harbor and inspected the pass or channel, it is unnecessary, I take it, to state the physical conditions at and surrounding the harbor and the pass, and I will therefore pretermit any consideration of the same.

The ports on the Gulf coast are the natural outlet for the products of the trans-Mississippi States and Territories. Aransas Pass is about 331 miles nearer to Omaha than any Atlantic port, 457 miles nearer Kansas City, 801 miles nearer Salt Lake, 663 miles nearer Helena, 770 miles nearer Denver, and 1,121 miles nearer Santa Fe. It is estimated that the trans-Mississippi corn crop is 51 per cent of that of the whole country, the wheat crop 58 per cent, and the cotton crop 46 per cent, and that of the cotton shipped Texas alone furnishes about 33 per cent, that their products in swine are about 44 per cent, and of cattle about 46 per cent. Kansas City is a great shipping center for a large proportion of these trans-Mississippi products. With these advantages in their favor, the Gulf ports should ultimately, when properly developed, form the outlet for the products of these trans-Mississippi States. If the percentage of exports therefrom should keep pace with the percentage of products, then there should go through these Gulf ports about 58 per cent of the wheat exports, 51 per cent of the corn exports, 46 per cent of the cotton exports, 46 per cent of the cattle exports, and 44 per cent of the swine exports.

The State of Texas alone can furnish exports sufficient to keep up all the harbors on the Texas coast that can be developed, and this would justify any expenditure the United States Government might make in the development and maintenance of these harbors.

The report of the railway commission of Texas of 1896 shows the total mileage of railroads in Texas, at the time of said report, to be 9,173, and that the tonnage of the freight carried for the twelve months ending June 30, 1896, by said railroads was 14,510,919, and the freight earnings during that time $25,586,640, and the total gross earnings $35,318,629.

Said tonnage for the twelve months ending June 30, 1896, was distributed as follows:

Grain	802,126
Flour	352,481
Other mill products	67,720
Hay	85,938
Tobacco	23,527
Cotton	1,064,110
Cotton-seed meal and cake	483,562
Oats	27,965
Fruits and vegetables	431,203
Other agricultural products, unclassified	241,633
Dressed meats, poultry, game, and fish	29,210
Other packing-house products	90,281
Wool	52,212
Hides and leather	29,758
Other animal products	8,554
Coal, coke, and lignite	1,726,530
Ores	129,857
Salt	53,432
Stone, sand, and other like articles	1,233,644
Other mineral products	1,444
Lumber	2,268,794
Shingles	79,037
Other forest products, unclassified	374,083
Petroleum and other oils	154,960
Sugar and molasses	190,253
Pig and other iron	26,850
Iron and steel rails	114,112
Other castings and machinery	127,944
Bar and sheet metal	80,493
Cement, brick, and lime	211,616
Agricultural implements	33,672
Wagons, carriages, and tools	43,904

Wines, liquors, and beer	216,492
Household goods and furniture	51,194
Other manufactures	421,236
Merchandise	1,295,259
Railroad materials not specified	142,091
Other exports not specified elsewhere	449,020

Of this tonnage, a total of 520,328 was carried by the San Antonio and Aransas Pass Railway, and 105,979 by the Texas and Mexican Railway, a connection of the Mexican National Railway. Both of these roads are now practically built to the port of Aransas.

The taxable values of the State, as shown by the comptroller's statement for 1896, are $850,309.246.

The products of the State, as shown by the last published report of the commissioner of agriculture, for the year 1895, are as follows:

Summary of products and values of agricultural crops of Texas in the year 1895, as far as reported by the assessors of the State.

Crop.		Product.	Value.
Cotton:			
Lint	bales	1,383,533	$50,840,895
Seed	tons	660,179	4,694,753
Corn	bushels	93,907,875	23,463,081
Wheat	do	1,269,580	622,636
Oats	do	16,867,807	3,166,012
Barley	do	61,018	21,023
Rye	do	8,826	5,625
Rice	do	26,547	14,881
Beans	do	24,094	29,544
Pease	do	243,503	238,341
Irish potatoes	do	741,958	452,591
Sweet potatoes	do	3,221,307	1,479,736
Ground pease	do	182,776	155,182
Tobacco	pounds	97,566	17,563
Sugar cane:			
Sugar	barrels	19,417	206,933
Molasses	do	17,097	327,324
Sorghum cane:			
Fodder	tons	410,706	1,563,120
Molasses	barrels	32,340	455,617
Millet, fodder	tons	136,549	707,031
Hungarian grass, fodder	do	2,233	10,224
Cultivated hay	do	67,411	355,479
Prairie hay	do	192,159	970,357
Broom corn	do	82	2,465
Gipsy corn	bushels	4,050	7,601
Jerusalem corn	do	792	320
Kaffir corn	do	72,061	19,508
Milo maize	do	212,243	66,908
Millet for seed	do	3,777	1,851
Total value		----------	89,896,601

Summary of products and values horticultural crops of Texas in the year 1895, as far as reported by the assessors of the State.

Crop.		Product.	Value.
Garden		----------	$2,854,239
Apples	bushels	233.611	173,401
Grapes	pounds	1,533,260	68,719
Wine	barrels	1,860	55,074
Peaches	bushels	1,733,814	883,073
Pears	do	50,284	55,302
Pecans	pounds	3,201,727	104,585
Plums	bushels	37,949	24,638
Blackberries	quarts	1,632	154
Strawberries	do	679,393	45,298
Celery		----------	3,275
Melons		----------	252,362
Onions	bushels	7,625	3,185
Total value		----------	4,523,305

To the totals of these summaries for 1895, 16 per cent should be added, as estimated for 37 counties from which no reports were received.

Summary of dairy and farmyard products of Texas in the year 1895, as far as reported by the assessors of the State.

Product.	Number.	Pounds.	Value.
Butter		14,087,302	$2,058,302
Eggs	183,804,180		1,384,364
Chickens	8,737,098		1,339,481
Ducks	65,289		17,924
Geese	125,326		56,543
Turkeys	292,790		153,375
Honey		1,523,041	141,770
Lard		17,206,430	1,640,479
Pork	115,677,088		5,851,638
Total value			12,643,876

Summary of statistics of stock raising in Texas, in the year 1895, as far as reported by the assessors of the State.

Product.	Number.	Pounds.	Value.
Cattle	2,341,900		$16,645,908
Goats	145,025		127,038
Hogs	1,322,816		2,757,027
Horses	671,715		13,628,153
Jacks and jennets	7,334		298,317
Mules	129,769		4,487,837
Sheep	1,589,378		1,555,554
Sheep, shorn	1,361,792	8,131,710	597.827
Total value			40,097,661

Summary of other farm statistics of Texas, in the year 1895, as far as reported by the assessors of the State.

Number of farms owned	145,958
Number of renters on farms	86,710
Number of laborers employed	37,961
Average monthly wages paid to laborers	$12.21
Value of farm implements	$3,256,545.00

NOTE.—The assessors of the following counties, numbering in all 37, failed to send to the department the statistics required: Armstrong, Atascosa, Brown, Calhoun, Cameron, Dallas, Fisher, Floyd, Frio, Guadalupe, Hartley, Hemphill, Irion, Jefferson, Jones, Kerr, Kimble, King, Kinney, Knox, La Salle, Loving, Nolan, Ochiltree, Oldham, Orange, Polk, Randall, Rockwall, San Patricio, Sherman, Swisher, Travis, Trinity, Walker, Ward, and Wheeler. As these omitted counties constitute 16⅔ per cent of the organized counties of the State, it is proper that an estimated addition of 16⅔ per cent should be made to the amounts given in the preceding summaries.

The San Antonio and Aransas Pass Railway extends from the city of San Antonio to the town of Rockport, passing through the town of Aransas Pass. At Kennedy Junction this road branches and goes through some of the most fertile counties of the State of Texas, extending as far northward as Waco. The town of Aransas Pass, through which it passes, is the nearest point to Harbor Island, and a terminal railway has been partially built from said town out in the direction of Harbor Island. When this road is completed it will give rail connection between the port and the said Aransas Pass Railway, thus connecting the harbor by this railway with the cities of San Antonio, Houston, Waco, and other smaller places. It is estimated that this railway will carry this year about 175,000 bales of the cotton product of Texas. A branch of this railroad also extends from San Antonio to Kerrville, leaving a short distance to be built to connect with the iron fields of Llano. The Mexican National Railway, with its connection, the Texas Mexican Railway, extends from Corpus Christi, in Texas, to Laredo, in Texas, and thence on to the City of Mexico. It would only be necessary to build a few miles of this road to connect it directly with the harbor of Aransas by way of the terminal railroad heretofore referred to. Your Board was present when the general manager of that road stated that they were ready to extend to deep water as soon as it was obtained. At Laredo this road meets the International and Great Northern, which extends from that city on through San Antonio, Austin, Palestine, and up to Longview, connecting with the Iron Mountain at Texarkana. The port of Aransas is about the same distance from the city of Monterey, Mexico, from which the Mexican National gets some of its most valuable business, as is the port of Tampico, Mexico, and it would be decidedly to the interest of this railway to utilize the port of Aransas instead of the port of Tampico, to which latter port it owns no line of railway, but must ship over the line of other carriers.

Before the construction of the Aransas Pass Railway and the development of the port of Galveston a line of steamers ran to Corpus Christi, passing over the bar at Aransas Pass and up to Corpus Christi through what is termed the Corpus Christi Channel, and, I am informed, did quite an extensive business, although the depth of water over the bar was then less than it is now.

It seems very evident, from the foregoing, that this port should be opened and maintained by the Government, and that the Aransas Pass Harbor Company, in its efforts to secure the deep water, has been performing a public duty that rested on the Government, and that, as shown by the exhibits hereto attached, it has spent a large amount of money on this work, and the Government should not hesitate to refund the money it has expended up to the present time and that it may hereafter spend prior to Congressional action, together with legal interest thereon.

As some of the most cogent reasons for such payment, I submit the following:

First. In view of the very large appropriation to Galveston, and the fact that the Government seemed to have selected that port as the one place on the Texas coast to make large expenditures, it seemed utterly hopeless for Aransas Pass to expect to secure any appropriation until the Galveston problem had been solved and the appropriation made therefor expended. This meant many years of delay, and in the event the problem was not solved satisfactorily at Galveston it could not reasonably have been hoped that the Government would try another experiment at another point on the Texas coast soon. The future of Aransas Pass as a port, therefore, seemed to be dependent entirely upon interesting private capital in the work of securing a navigable channel across the bar, and the Aransas Pass Harbor Company was incorporated in order to accomplish that purpose.

Second. The work so far done at Aransas Pass is permanent in its character, cheaply done, and valuable to the Government, and had the Government undertaken to secure deep water the same amount of money would doubtless have been spent in the same or similar work.

Third. By the wording of the act of Congress granting to the company the right to construct the channel across the bar, it is very evident that the Government contemplated payment for the work done in the event it subsequently resumed control of the channel. Upon the faith of the wording of this act, money was invested to do the work that has been done at the pass.

Fourth. In order to raise the money necessary to do the work that has been done, the harbor company has had to negotiate its bonds at a discount, and, assuming that the bonus lands given to the company are of the value affixed thereto by the grantors, it could not reasonably be anticipated that these lands could be sold for more than enough to pay for the discount on the bonds, while the company would still remain obligated to pay the face of the bonds. The actual amount, therefore, expended on the work as the proceeds of the sale of these bonds will not be returned to the company, even should its lands be sold, and, in order to realize on any of its investments, the company will have to expend other large sums of money in the development of the port.

Fifth. Sufficient work has already been done at the pass by the company to demonstrate the entire feasibility of obtaining the necessary depth of water by the expenditure of a practically small additional amount, and the Government has, therefore, had the problem of deep water solved for it at this port. But, however this may be, the effect of the large appropriation made for Galveston Harbor, and the failure to make any appropriation for the work at Aransas Pass, has practically stopped the commerce that theretofore had been going to the latter port. When the deep water is obtained the port, therefore, will have to be redeveloped, and this development will depend upon natural conditions and also upon the enterprise of the Aransas Pass Harbor Company, and will require the expenditure of a large amount of money by that company in addition to the amount that it has already expended in the work at the pass. The Government, therefore, should not hesitate, in taking charge of the work, to pay the company for services rendered toward securing water in the pass, and thus better enabling the company to make the port available by developing commerce there. The Government would get the benefit of such development in the commerce in the way of import duties collected, and this would amply compensate it for any money spent in payment to the company and in the future maintenance of the deep-water channel across the bar.

Sixth. Under the terms of the act appointing the Board, a purchase of the company's works, and not a forfeiture of its franchises and condemnation of its properties, was evidently contemplated by the Government. The conclusion of the second clause of the act reads: "And such other information as they may deem essential to be known to Congress in making future provision for the purchase of said works by the United States Government."

Seventh. An appropriation to pay for the actual work done, and the expense of doing same, will not compensate the company for all of the work done in developing this port. Owing to the situation of the harbor, it is necessary to the development of same that it shall be connected with the main shore by terminal railroads or dredged channels, and the company has spent a large sum on the former, and will have to spend still further sums on same, and also on the latter. By the dredging of channels it gets certain franchises under the State law, but these franchises are conditioned on such channels being free to navigation. Even should the Government pay back the money expended, obtain and maintain the channels, still it would need the aid of the company in the development of the port, and every dollar spent by the company in that direction would result in a benefit to the Government, in that the Government's money would be returned to it in the shape of the additional import duties it would receive from an increased commerce through this port.

Eighth. In granting the company the right to secure a deep-water channel, the Government stipulated that the channel should be free to navigation, but authorized the company to "own" the breakwaters, jetties, and auxiliary works constructed by it. reserving to the Government the right to purchase same. It is evident, therefore, that the Government did not contemplate utilizing the expenditures of the company in the future without full compensation therefor. If the Government now takes charge of the work, it must either forfeit the company's franchises, purchase its properties, or obtain a voluntary surrender from the company of its rights. Even in case of a forfeiture, it certainly could not utilize the jetties and breakwaters built by the company without compensation.

No reason can exist for the forfeiture of the franchises of a company that has spent thousands of dollars in the work of securing a deep-water channel, and has continued to expend money in efforts in that direction through a series of years of business depression that has driven many other enterprises to the wall.

Respectfully submitted.

THOS. H. FRANKLIN,
President Aransas Pass Harbor Company.

Col. H. M. ROBERT,
Chairman Board of Engineers.

EXHIBIT A 1.

CHARTER OF ARANSAS PASS HARBOR COMPANY.

THE STATE OF TEXAS, *County of Bexar:*

Know all men by these presents that we, E. P. Swenson, M. Kennedy, U. Lott, A. C. Schryver, A. W. Houston, B. F. Yoakum, and Reagan Houston, have agreed one with another to become a corporate body for the purposes hereinafter recited, and do hereby associate ourselves as such under and by virtue of the laws of the State of Texas concerning private corporations, and for that purpose we hereby adopt and subscribe the following charter:

ARTICLE 1. The name of the corporation hereby created shall be The Aransas Pass Harbor Company.

ART. 2. This corporation is formed for the purpose of constructing, owning, and operating deep-water channels from the waters of the Gulf of Mexico along and across Aransas Pass and along and across Nueces and Aransas bays and the channels and inlets thereto, and constructing, owning, and operating docks, wharves, entrances, moorings, approaches, and ways into, on, and across said pass, bays, and channels, and the surrounding and neighboring mainlands and islands, and for the construction, use, and enjoyment of such warehouses, stores, and sheds as may be necessary for receiving and discharging freights, goods, wares, and merchandise, and the proper protection and preservation thereof, and to provide facilities for vessels and boats entering said Aransas Pass Harbor for anchorage and receiving and discharging cargoes and passengers, and to charge and collect tolls and wharfage therefor.

ART. 3. The principal office of this corporation shall be in San Antonio, Bexar County, Tex.

ART. 4. This corporation shall exist for a term of fifty years.

ART. 5. The business of this corporation shall be transacted by six directors, who shall be elected by the stockholders, and E. P. Swenson, a resident citizen of New York State; U. Lott, a resident of Bexar County, Tex.; M. Kennedy, a resident citizen of Nueces County, Tex., and A. C. Schryver, A. W. Houston, and B. F. Yoakum, resident citizens of Bexar County, Tex., shall constitute the board of directors for the first year.

ART. 6. The amount of the capital stock of this corporation shall be $2,000,000, divided into 20,000 shares of $100 each.

In testimony whereof we have hereunto signed our names, in San Antonio, Tex., this 22d day of March, A. D. 1890.

B. F. YOAKUM.
A. C. SCHRYVER.
REAGAN HOUSTON.

STATE OF TEXAS, *County of Bexar:*

Before me, L. Wm. Menger, a notary public in and for Bexar County, Tex., on this day personally appeared A. C. Schryver, B. F. Yoakum, and Reagan Houston, all known to me to be the persons whose names are subscribed to the foregoing instrument of writing, and each acknowledged to me that he had executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this 28th day of March, A. D. 1890.

[SEAL.]

L. WM. MENGER,
Notary Public, Bexar County, Tex.

DEPARTMENT OF STATE:

I, Geo. W. Smith, secretary of state of the State of Texas, do hereby certify that the foregoing is a true copy of the original charter of the Aransas Pass Harbor Company, with the indorsements thereon, as now appears of record in this department.

Witness my official signature and the seal of State affixed at the city of Austin this 15th day of December, A. D. 1891.

[SEAL.] GEO. W. SMITH, *Secretary of State.*

EXHIBIT A 2.

AN ACT to be entitled an act to authorize and permit the Aransas Pass Harbor Company to purchase from the State of Texas Harbor Island, certain shoal waters and flats in front thereof and in Red Fish Bay, on the Gulf coast of Texas, in order to encourage the procuring and maintenance of deep water at Aransas Pass, and prescribing certain conditions attaching to and following such purchase.

Be it Enacted by the Legislature of the State of Texas:

SECTION 1. The Aransas Pass Harbor Company shall be permitted to purchase from the State of Texas, at two dollars per acre, all or any portion of Harbor Island, situated near Aransas Pass, on the Gulf coast of Texas, as well as the shoal waters and flats lying in front of said island on its east side out to the present deep channel; also, all and any flats and shoal waters in Red Fish Bay lying in one-half mile of any deep-water channel, navigable for seagoing boats, that may be hereafter constructed by said company through or in said Red Fish Bay, connecting the same with Aransas or Corpus Christi Bays, or the Morris and Cummins Channel, and extending to the shore of Red Fish Bay at and near the present town site of Aransas Pass; and provided further, that any channel so constructed in Red Fish Bay shall be throughout at least sixty feet wide at the bottom and five feet deep; and provided further, that said company shall not be permitted to purchase any flats or shoal waters in Red Fish Bay lying within one-half mile of any private holdings fronting on said Red Fish Bay on the side next to the present town site of Aransas Pass; provided, that all channels excavated or constructed by said Aransas Pass Harbor Company under the authority of this law shall forever remain open and free to all vessels without fee or charge; provided, that said company shall not be permitted to purchase the twenty-five acres of Harbor Island heretofore patented to the United States, and on which Aransas Lighthouse now stands, nor the shoal waters or flats in front thereof, nor the land on which the State Quarantine Station is now situated on said island, nor the shoal waters or flats in front thereof, which said land is hereby especially reserved to the state, and which said land so reserved is described as follows:

Beginning at a point situated at mean low-tide mark on the east shore of said Harbor Island, one-half mile in a northerly direction from the center of the foot or shore end of the present quarantine wharf; thence in a southerly direction along the east shore of said island at mean low-tide mark, with its meanders, one mile to the southeast corner of said tract of land; thence in a westerly course at right angles with the general course of the line above established, one-half mile, establish corner for southwest corner of this tract; thence in a northerly direction parallel with the general course of the east line of this tract as herein first above provided, one mile, establish the northwest corner of this tract; thence in an easterly direction parallel with the south line of this tract one-half mile to point of beginning on east shore of Harbor Island for northeast corner; provided, however, that if said described property is abandoned by the state as a quarantine station and hereafter put upon the market for sale or lease by the state, the said Harbor Company shall have the preference right to buy or lease same at the price that may hereafter be put thereon by the state; provided, however, that such preference shall continue for ninety days only after the time said property is put on the market by the state for such sale or lease; provided further, that said company shall not be permitted to purchase or acquire under this act the shallow bay or cove locally known as Turtle Cove, and situated between Harbor Island on the north end and northwest, and Corpus Christi Bay on the west side, and Mustang Island on the south and southeast, and Aransas Pass and Aransas Bay on the east and northeast; provided further, that said company shall not purchase or acquire any of the shoal waters or flats adjoining what is known as Shell Bank Island, Tally Island, and the shell reef running towards the mainland from said island. Be it further provided, that nothing in this act contained shall be so construed as to affect or impair the vested rights of any person, firm, association of persons or corporations.

SEC. 2. To entitle said Aransas Pass Harbor Company to acquire any title to said lands, shoal waters or flats, or any part thereof, under the provisions of this act, the said company shall have constructed a navigable channel twenty feet deep at mean low tide, one hundred and fifty feet wide at the bottom, on and across Aransas bar, connecting the deep water of the Gulf of Mexico with the deep water of Aransas Bay, by the 1st day of January, 1899, and shall have maintained said depth of twenty feet continuously for two years after obtaining same throughout the length and breadth of said channel. The depth of said channel shall be determined at mean low tide by the engineer in charge of the work and by a competent engineer appointed by the Governor of the State of Texas for that purpose, and who shall be paid for such service by said company while engaged in said service, whose joint certificate as to the depth of water on said bar, showing full twenty feet of water in said channel throughout its entire length and breadth, and for the time required by this act, shall be evidence thereof, unless legally controverted, sufficient to authorize the Commissioner of the General Land Office to issue patents to said company for such lands as the said company shall elect to purchase under this act; provided, that said engineers shall make said measurements at least twice annually, and at least six months apart, after said twenty feet of water has been obtained, and the certificate of each measurement shall be filed with the Commissioner of the General Land Office within thirty days after such measurement is made, and each certificate shall show full twenty feet of water at mean low tide throughout said channel.

SEC. 3. Said Aransas Pass Harbor Company shall not be entitled to apply for the purchase, or for a survey with the view or purpose of purchasing, any of said lands, flats or shoal waters before said company shall have procured, constructed, or caused to be constructed, a navigable channel on, across and through said bar, having a depth of fifteen feet of water at mean low tide and being one hundred and fifty feet wide at its bottom. The depth of water in said channel shall be determined by the same authority, and in the same manner as is prescribed in the preceding section of this act, for determining the depth of the twenty-foot channel. Upon the joint certificate of said engineers showing that said depth of fifteen feet of water has been obtained, and the application for survey of said company being filed with the Commissioner of the General Land Office, said company shall be entitled to have the land, shoal waters or flats applied for surveyed and platted as in other cases as provided by statute for the sale of unappropriated public domain, which survey, plat and field notes shall be made by the county surveyor of the county where such land, shoal waters or flats are situated, and after being by him returned to the Commissioner of the General Land Office, and there filed, after which said company may make application for the purchase of such lands, shoal waters and flats as indicated by such surveys, plats and field notes so filed in the General Land Office.

SEC. 4. Upon the written application of said Aransas Pass Harbor Company to the Commissioner of the General Land Office, accompanied by one-fifth of the purchase money for said land, shoal waters or flats, or the part thereof intended to be purchased, the Commissioner of the General Land Office shall execute his receipt for the money when paid, and plat the field notes upon the maps of his office, and the remainder of said purchase money may be paid thereafter at any time within five years, the deferred payments to bear interest at the rate of five per cent. per annum, payable annually, until said purchase money is fully paid. One-half of the proceeds of any such sale shall belong to the permanent school fund and one-half to the general revenue of the state. If the said Aransas Pass Harbor Company shall fail to pay the said annual interest upon any part of the purchase money when said interest shall become due, or shall fail to pay the principal when the same shall become due, then all rights acquired under the purchase, with all payments made thereon, shall be forfeited without judicial ascertainment of such forfeiture, and the Commissioner of the General Land Office shall endorse upon the contract of purchase that the same is forfeited, whereby all rights so acquired shall be forfeited and revert to the state; provided, that no patents shall issue for such land, shoal waters or flats until the provisions of Section 2 of this act have been complied with, and all purchase money and interest is paid; provided, that the application to purchase the lands herein permitted to be purchased, and the first payment of one-fifth of the purchase price thereof, shall be made not later than two years after a depth of twenty feet has been obtained, as shown by the certificate of the engineers herein provided for.

Sec. 5. The sale of lands herein authorized, and the rights herein granted, shall be coupled with the following conditions: That all navigable channels constructed by said company shall forever remain open and free to all vessels without fee or charge; the tolls and charges for the use of docks and wharves constructed on any portion of said lands shall be equal, just and uniform to all vessels, persons and corporations without discrimination as to amount charged or delay in handling the same, and all such tolls and charges shall be under the control of the legislature of the State of Texas; and, until otherwise directed by the legislature, shall be subject to control and regulation by the Railroad Commission of Texas, under the rules prescribed for the regulation of railroads, so far as applicable; and any railroad or other means of transportation which may be constructed between the mainland and said wharves and docks or deep-water channels shall be a public highway, and all rates and charges for the transportation of freights and passengers thereon shall be subject to the control and regulation of the Railroad Commission as a railroad; such railroad or other means of transportation shall receive from each and every ship, boat and vessel, or from the wharf on which the same is discharged, all freights and passengers and transfer and deliver them to the consignee or any connecting line of road without discrimination as to charges or delay in transportation and delivery, and shall in like manner receive from every person, and from every connecting line of railroad, all freights and passengers and transport and deliver the same to each and every ship, boat, vessel, person or corporation for delivery to such ship, boat or vessel on like equal and just terms without discrimination as to charges and delay in transportation or delivery thereof.

Sec. 6. The privileges and rights granted under this act shall not be exercised so as to hinder or interfere with the completion of any terminal or suburban railroads heretofore chartered so far as and rights which it now has under said charter to build to and upon Harbor Island, nor to hinder or interfere with any such terminal or suburban railroad which now has the right under its charter to acquire and control depot grounds, wharf grounds and deep-water fronts.

Sec. 7. The great importance of continuing the work for deep water at Aransas Pass, and the necessity of securing it at the earliest possible day, and the fact of the vast amount of business before this session of the legislature, and the length of the session being limited, create an imperative necessity and an emergency which demands that the constitutional rule requiring bills to be read on three several days be suspended, and this act take effect and be in force from and after its passage, and it is so enacted.

Sec. 8. That all laws in conflict with any of the provisions of this act be, and the same are, hereby repealed.

Note.—After passage of above act it was amended, and to avoid attaching copy of amendment the clauses stricken out by the amendment are left out of the above copy, and same shows the act as it now reads.

Exhibit A 3.

[AN ACT for improving Aransas Pass.]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Aransas Pass Harbor Company, a corporation duly chartered under the laws of the State of Texas, and their associates, assigns, successors, and representatives be, and they are hereby, authorized on the conditions hereinafter mentioned, to construct, own, and operate such permanent and sufficient jetties and breakwaters and such auxiliary works as are necessary to create and permanently maintain, as hereinafter set forth, a navigable channel across the outer bar, which obstructs the entrance to Aransas Pass Harbor, on the coast of the Gulf of Mexico, in the State of Texas, and so far into the bays and navigable waters as may be necessary to reach a place that will afford ample dockage and protection from storms, swells, cyclones, and tidal waves for the purpose of furnishing the vessels and boats adapted to the purpose, facilities for navigation in and along the entire length of said channel, and for that purpose they may construct in the Gulf of Mexico and in and across the bays and navigable waters adjacent thereto such walls, jetties, dikes, levees, and other structures, and employ such boats, rafts, bridges, and appliances, as they may in the prosecution of said work deem necessary: *Provided*, That no such structure or means employed shall hinder, delay, or interfere with the free navigation in said channel, harbor, bays, or navigable waters: and to protect their said works they may build and maintain such levees, embankments, walls, or riprap as may be necessary to secure their permanency along the banks or shores of Mustang, St. Joseph, and Harbor Islands as the United States is authorized to grant, and to utilize such works as the Government has already constructed, and will hold the United States harmless from any damage that may accrue to any person or persons by the construction of said walls, jetties, dikes, levees, and other works constructed thereunder: *Provided further*, That unless the construction of the proposed work shall be commenced within one year from date of approval of this act and be diligently prosecuted by the expenditure of at least three hundred thousand dollars per annum thereafter in the prosecution thereof until twenty feet depth of water over the outer bar is obtained, the grant of privileges herein shall be forfeited; and unless the said company, their associates, assigns, successors, or legal representatives, shall secure a navigable depth over said outer bar of fifteen feet of water within three years after the date of the approval of this act, and a navigable depth of twenty feet of water over said bar within five years from said date, then Congress may revoke the privileges herein granted in relation to said improvements.

SEC. 2. That at any time after said improvements and auxiliary works have been completed as herein provided, and said depth of twenty feet has been obtained, the United States shall have the right to pay the said company, or their assigns, successors, or legal representatives, the value of the works constructed under this act or under or by virtue of any authority granted by the State of Texas, and on such payment being made by the United States all rights to said work on the part of said parties shall cease, but nothing in this act shall be construed as compelling the Government to take possession of and pay for said work unless so desired. Nothing within the provisions of this act shall be construed as authorizing the said company to charge or collect tolls or tonnage upon boats or vessels navigating said channel and the navigation of the same shall be free.

Approved, May 12, 1890.

EXHIBIT A 4.

STATEMENT OF AMOUNTS EXPENDED BY ARANSAS PASS HARBOR COMPANY ON WORKS AT PASS.

Nelson or south jetty account.

Total amount actually paid out in construction of Nelson Jetty, including cost of tools and material, all of which was paid prior to January 1, 1895	$53,834.17
Add 6 per cent interest on this sum from January 1, 1895, to January 1, 1898	9,690.15
Amount since paid on debts contracted in erecting said jetty	13,232.29
Add 6 per cent interest from August 1, 1897, to January 1, 1898	463.13
Salaries of officers to July 1, 1895	15,000.00
Add 6 per cent interest from said date to January 1, 1898	2,250.00
Amount indebtedness incurred in construction of said jetty still unpaid, for which harbor company is liable, with interest calculated to August 1, 1897	13,000.00
Total expenditures chargeable to Nelson Jetty account	107,469.74

North jetty account.

Engineers' salaries paid		$7,033.40
Engineering expenses paid		6,710.31
Officers' and employees' salaries paid		13,987.67
Engineer's salary to August 1, 1897, unpaid		1,050.00
Assistant engineer's salary to August 1, 1897, unpaid		150.00
Officers' and employees' salary to August 1, 1897, unpaid		1,050.00
C. P. Goodyear, amount advanced for work under his contract		2,250.00
Stationery and office printing		444.87
Add 6 per cent interest on totals of above from August 1, 1897, to January 1, 1898		1,143.67
Total amount paid Charles Clarke & Co. for construction of north jetty		235,000.00
		268,819.92
Add 6 per cent interest to January 1, 1898, on payments to Clarke & Co., as follows:		
From January 1, 1896, on	$145,000.00	17,400.00
From January 11, 1896, on	1,247.90	148.71
From February 14, 1896, on	12,446.52	1,420.97
From March 16, 1896, on	24,568.90	2,665.73
From April 25, 1896, on	5,033.70	512.60
From May 8, 1896, on	3,216.62	320.58
From July 23, 1896, on	16,161.94	1,406.09
From August 15, 1896, on	4,198.68	349.19
From March 31, 1897, on	23,125.74	1,040.65
	235,000.00	294,084.44

Recapitulation.

Total expenditures on Nelson or south jetty, with interest	$107,469.74
Total expenditures on north jetty, account and interest	294,084.44
	401,554.18

In addition to the foregoing the company has expended, in round numbers, $123,000 in payment of taxes, purchase and construction of terminal railways, protection of its properties, payments of debts, purchase of part of Harbor Island, and incidental expenses.

EXHIBIT B.

Summary of commerce passing through Aransas Pass, Texas, as reported in the Annual Reports, Chief of Engineers, from 1879 to 1890, inclusive, with exception of part of 1880, which is given in separate list.

Bones	pounds	885,000	Ore	pounds	520,982
Cattle	number	129,521	Railroad iron	tons	6,600
Cedar piles	do	610	Salt	sacks	200
Coal	tons	1,353	Stone	tons	490
Coal oil	cases	6,972	Sheep		1,416
Cotton	bales	1,318	Shingles		5,481,000
Dry hides	pounds	2,572,179	Tallow	pounds	1,154,350
			Wet salted hides	do	75,000
Dry hides, skins, wool, etc.,	pounds	839,524	Wool	bags	88
Dryskins in bales	pounds	700,782	Wool	pounds	6,790,416
Fish and turtle	do	445,060	Beef (in tin)	do	2,492,400
General merchandise	do	31,109,564	Tongue (in tin)	do	31,155
General merchandise	bbls	190,556	Neat's-foot oil	do	12,800
Horsehair	pounds	26,156	Blood	do	83,080
Horses		186	Rethes	do	35,309
Hogs		65	Hoofs		20,770
Horns	pounds	2,260	Shin bones	pounds	49,848
Ixtle	do	368,312	Knuckles	do	28,039
Lumber	feet	25,079,788	Hair	do	3,530
Lumber and shingles	tons	9,329	Tankings		830,800
Mules		35	Horns	number	41,540

Report of treasurer Corpus Christi Wharf and Warehouse Company for fiscal year 1880, stating that Aransas Bar was closed, and that most of the freight was taken by lighters through the bays to Indianola for shipment.

Wool	pounds	6,500,000	Skins	pounds	792,000
Hides, green salted		1,700	Horsehair	do	42,000
Bones	tons	154	Tallow	barrels	65
Kips, dry	pounds	177,000	Merchandise	do	120,000
Sheep		300	Lumber	feet	4,500,000
Hides, dry		65,000	Shingles		1,500,000

Exhibit C.

JOINT LETTER OF MESSRS. LEWIS M. HAUPT AND H. C. RIPLEY, CONSULTING ENGINEERS.

Philadelphia, *June 12, 1895.*

Gentlemen: In accordance with your request, through Brewster Cameron, esq., we have the honor to submit the following brief description of the proposed breakwater for Aransas Pass, Tex., and the results we confidently predict from its construction.

The work will be entirely of stone, or of stone with a thin brush mattress extending under a portion of a whole of its length, which will be 6,200 feet. In section, it will have a top width of 10 feet, rising to a height of 3 feet above the plane of mean low water. The slopes will be 1½ horizontal to 1 vertical, and the base will vary, according to depths, from 40 to 70 feet.

In plan it will differ from the usual form of jetty or breakwater, being detached from the shore and located on the bar to the "windward" of the channel. Its axis will be curved (compound and reverse) to produce reactions similar to those found in the concavities of streams, and having radii sufficient to maintain channels of the requisite depths, as revealed by existing curves and their resulting depths of over 30 feet, now found inside the bar. It is designed to fulfill the fundamental conditions of (*a*) arresting the littoral drift; (*b*) admitting the full tidal prism to the interior lagoons; (*c*) controlling the ebb currents and producing a reaction across the bar; (*d*) changing the conditions of equilibrium of flood and ebb currents in favor of the latter; and (*e*) of affording aids to navigation by a structure of only half the length of the usual convergent or parallel jetties in pairs.

The work will be executed in two parts. The first will consist of 1,250 feet of completed breakwater and 2,500 feet of foundation extension; the second, of 5,950 feet of completed breakwater and 250 feet of foundation extension. It is to be covered with a substantial apron of heavy blocks, weighing from two to five tons, carefully placed so as to produce a permanent and substantial structure.

The construction of the proposed breakwater, as designed, will unquestionably result in securing navigable depths over the bar of 15 feet for the first part of the work and 20 feet for the second.

The development of these depths will commence immediately upon the construction of the foundation course, which will be greatly hastened by the strong currents resulting from the "northers," and which occur between September and March. If a more rapid development of depths is desired than will result from natural causes, deepening may be facilitated by dredging or other auxiliary appliances.

Since the forces necessary to maintain a channel are much less than those required to create it, a channel once developed and protected from silt, as this will be, may be maintained by the natural tidal currents from the bays; hence the cost of maintenance under the plan proposed would be a minimum.

Respectfully submitted.

Lewis M. Haupt,
H. C. Ripley,
Consulting Engineers.

Exhibit D.

LETTER OF CHIEF ENGINEER OF ARANSAS PASS HARBOR COMPANY.

Ropesville, Tex., *September 19, 1896.*

Dear Major: Replying to your favor of the 11th instant, requesting estimates of quantities to complete breakwater, I beg to hand you herewith my estimate, embracing the amount of work yet to be done in accordance with the original design and plans submitted by yourself and Professor Haupt.

This original plan contemplated "a breakwater, A, B, C, D, E, about 6,200 feet in length, located as shown on blue print," and consisting of "a foundation of brush not to exceed 2 feet thick, covered with stone 3 feet thick, and with widths as follows":

First, 2,000 feet, E to D, 40 feet wide; next, 1,700 feet, 50 feet wide, and the next, 2,500 feet, 60 feet wide, "and a superstructure having a top width of 10 feet, at an elevation of 3 feet above the plane of mean low tide, and with side slopes of 1½ horizontal to 1 vertical."

The work thus constructed has been carried out strictly on these lines, the amount done to date being as follows:

First contract: 1,000 feet of foundation, F to B; 1,250 feet of complete breakwater, B to C; 1,500 feet of foundation only, C to D. Material and cost: 3,750 linear feet of mattress work, F to D; 23,032 cubic yards riprap on foundation 3 feet high, F to D; 6,584 cubic yards riprap core+5,560 cubic yards block (capping)=12,144 cubic yards (superstructure, B to C, 1,250 linear feet). Total cost, $145,000, less $3,800, deducted for 38 days' overtime.

Second contract: 1,400 feet of foundation, D to D+1,400, and 1,500 feet core, C to D. Material and cost: 1,400 linear feet of mattress work, D to D+1,400; 6,216 cubic yards of riprap on foundation, D to D+1,400; 3,878.33 cubic yards of riprap core, C to D. Cost, $38,263.32.

Third contract: 1,500 linear feet, core and superstructure, C to D. Material and cost: 3,508.11 cubic yards riprap, C to D; 3,622.75 cubic yards block, D to D—500 feet. Cost, $28,523.44. This portion of breakwater was not completed, about 1,000 linear feet yet remaining to be capped.

Fourth contract: 600 linear feet of mattress, D+1,400 to E, and partially building up core to surface of water (not full width), with quarry-run stone. Material and cost: 552 linear feet of mattress work; 4,027.85 cubic yards of stone, quarry run, consisting of small block and riprap. Cost, $16,939.40.

The above costs do not include engineering expenses.

Now, the necessary work to be done is as follows:

First. To build 450 linear feet foundation, F–A, or 450 linear feet mattress, 60 feet wide, covered with riprap 3 feet high.

Second. To build up and complete 200 feet of superstructure, sloping the Gulf end, and leaving 250 feet foundation.

Third. To build up and cap (complete) B–F, 1,000 linear feet in length.

Fourth. To complete C–D, 1,000 linear feet, with capping stones.

Fifth. To build up D–E, 2,000 linear feet, with riprap, full width, and cap same.

Sixth. To fill gaps in crown of B–C where smaller block stones have been washed over by storms since contract was completed.

The material required for such work will be as follows:

No. 1. Four and one-half mattresses 100 feet long by 60 feet wide by not over 2 feet in thickness, composed of 9-inch diameter fascines and bonding poles above and below; 3,500 cubic yards riprap (3 feet high) on foundation.

No. 2. Four thousand four hundred and fifty cubic yards riprap for core; 1,760 cubic yards block for capping; total, 6,210 cubic yards.

No. 3. Fourteen thousand six hundred cubic yards riprap for core; 7,000 cubic yards for capping; total, 21,600 cubic yards.

No. 4. Nine thousand cubic yards block stone for capping, a small proportion of riprap for interstices.

No. 5. Six thousand four hundred cubic yards riprap for core; 5,300 cubic yards block for capping; total, 11,700 cubic yards.

No. 6. One thousand cubic yards block with small proportion riprap for patching.

In all, about 29,000 cubic yards of riprap and 24,000 cubic yards of block stone; total, 53,000 cubic yards stone, and the necessary mattresses.

Stone can be supplied from two sources: Rockport, from quarries along the line of the San Antonio and Aransas Pass Railway at Falls City and Kerrville; Corpus Christi, from quarries along the line of the Mexican National Railway between Corpus Christi and Laredo.

Brush for mattress work can be had at Rockport.

Last fall there was a deepening of the water at Gulf end of breakwater from B to A or F, but since spring of this year there has been some shoaling up of the sand at outer end and present depths are not so great.

I can not urge too strongly that work on the breakwater, particularly the Gulf end, be begun at once, for after October there is but little chance to work in the heavy seas prevailing during the winter months.

Very truly, yours,

Wm. D. Jenkins, *Chief Engineer.*

Maj. H. C. Ripley,
Consulting Engineer, Galveston.

I, T. B. Wheeler, secretary of the Aransas Pass Harbor Company, do hereby certify that the within and foregoing paper is a true and correct copy of the original it purports to represent.

In testimony whereof, I hereunto sign my name and affix the seal of the company, this 1st day of August, 1897.

[SEAL.] T. B. WHEELER, *Secretary.*

EXHIBIT E.

BID OF MESSRS. CHARLES CLARKE & CO. FOR CONSTRUCTING BREAKWATER.

BALTIMORE, *June 8, 1895.*

GENTLEMEN: Herewith we beg to hand you our bid for the construction of a breakwater at Aransas Pass, Texas.

First. We will build 1,250 feet of completed breakwater and 2,500 feet of foundation extension, as per specifications attached, and as per cross sections marked fig. 1 and fig. 2 in accompanying blue print for the sum of $143,000.

Second. We will build 6,000 feet of completed breakwater and 200 feet of foundation extension, as per specifications attached, and as per cross sections marked fig. 1 and fig. 2 on blue print for the sum of $285,000.

Yours, very truly.

CHARLES CLARKE & CO., *Galveston, Tex.*

Messrs. ALEXANDER BROWN & SON,
Baltimore.

EXHIBIT F.

CONTRACT BETWEEN MESSRS. CHARLES CLARKE & CO. AND BREWSTER CAMERON.

This agreement, made this 3d day of July, 1895, between Charles Clarke and Robert P. Clark, of Galveston, Texas, copartners under the firm name of Charles Clarke & Co., of the first part, and Brewster Cameron, of Philadelphia, Pennsylvania, party of the second part:

Whereas by an agreement in writing between the Aransas Pass Harbor Company and the said Cameron, dated ——, 1895, it was recited that, whereas the said Aransas Pass Harbor Company is a corporation incorporated under the laws of the State of Texas, with a capital stock of two million dollars ($2,000,000), divided into twenty thousand shares of the value of $100 each, for the purpose of constructing, owning, and operating deep-water channels from the waters of the Gulf of Mexico along and across Aransas Pass and along and across Aransas and Nueces bays, and the channels and inlets thereto, and constructing, owning, and operating docks, wharves, entrances, moorings, approaches, and ways into, on, and across said pass, bays, and channels, and the surrounding and neighboring mainlands and islands, and for the construction, use, and enjoyment of such warehouses, stores, and sheds as may be necessary for receiving and discharging freight, goods, wares, and merchandise, and the proper protection and preservation thereof, and to provide facilities for vessels and boats entering said Aransas Harbor for anchoring, and receiving and discharging passengers and cargoes, and to charge and collect tolls and wharfage therefor; and

Whereas in and by an act of Congress of the United States of America, approved May 12th, 1890, entitled, "An act for improving Aransas Pass," and an amendment thereto approved January 22nd, 1894, entitled "An act to amend an act of Congress approved May 12, 1890, granting to the Aransas Pass Harbor Company the right to improve Aransas Pass," certain rights and privileges of great value were given to the said harbor company; and

Whereas in and by an act of the legislature of the State of Texas entitled, "An act to encourage the construction and maintenance of deep-water harbors, navigable channels, docks, and wharves on the Gulf coast within the State of Texas, and to define the rights and duties and fix the liabilities of the corporations that may acquire land or privileges under this act," which act was presented to the governor for his approval on the 11th day of April, 1891, and became a law without his signature, the said harbor company will receive, acquire, and own certain lands, islands, shores, shallow bays, and other rights and privileges of great value provided said harbor company shall conform to the requirements and provisions of the said act; and

Whereas the said harbor company has been engaged in building and erecting certain jetties and works to secure the said deep-water channel at the said Aransas Pass, and has laid out and expended more than one hundred thousand dollars ($100,000) in the prosecution of its said work, but is unable to provide, raise, or secure the money needed and required to complete the work and pay the debts of the said harbor company, and for the purpose of securing the prosecution of said work has entered into the said contract and agreement, dated ———, 1895, with the said Brewster Cameron; and

Whereas in the said agreement, dated ———, 1895, it was, among other things, provided that the said Cameron undertook and agreed to build for the said Aransas Pass Harbor Company, on the north side of the entrance to the said Aransas Pass, 1,250 feet of complete breakwater and 2,500 feet of foundation extension, in conformity with the plans and specifications of Prof. Lewis M. Haupt, of Philadelphia, Pennsylvania, and H. C. Ripley, of Galveston, Texas, consulting engineers, heretofore prepared, subject to such modifications as may be agreed upon between the consulting engineers and the engineer who may be in charge of the works, and subject to the direction and control of such engineer; the said work to be performed within the time required by the said act of Congress and the said amendments thereto; and that the said Brewster Cameron shall have the free use of all machinery, boats, barges, materials, wharves, houses, fixtures, and all other property and appliances now belonging to said harbor company and heretofore used in the improvement of the said pass, and that the use of the same by the said Cameron shall be without cost, charges, or liability for damage or injury thereto resulting from the use of the same, and the said Harbor Co. shall also transfer and assign to the said Brewster Cameron all the right, title, and interest of the said harbor company in and to a certain contract with the San Antonio and Aransas Pass Railway Co., dated the 1st day of September, 1892, for the delivery and hauling of stone and materials for the improvement of said Aransas Pass. And that the said Harbor Co. and the officers and directors of said Harbor Co. shall give to the said Brewster Cameron such aid and assistance, in the way of necessary resolutions, acts, authority, and attention to the affairs of the company as may be required to secure the successful accomplishment of the said work undertaken by the said Brewster Cameron, as aforesaid, and will not in any way hinder, attempt to prevent, annoy, disturb, or place any obstacle in the way of the successful accomplishment of this work by the said Brewster Cameron; and

Whereas, in pursuance of, and to enable the said Cameron to perform the said agreement dated ———, 1895, these presents are executed:

Now, therefore, this agreement witnesseth, that for and in consideration of the premises and the sum of $5, paid by each of the parties hereto by the other, the receipt of which they do respectively acknowledge, the said parties of the first and second parties hereto, for themselves and their respective heirs, executors, administrators, and assigns, do severally covenant and agree as follows:

First. The said parties of the first part do hereby covenant, promise, and agree to and with the said part of the second part, that they, the said parties of the first part, shall and will, for the consideration hereinafter mentioned, begin within thirty days hereof, and will, on or before the 15th day of December, 1895, well and sufficiently build, construct, complete in every respect, and deliver in true and thoroughly workmanlike manner to the said party of the second part, a breakwater of all rock, or rock with a light brush foundation, at Aransas Pass, Texas, according and agreeably with the said plans and specifications, which are hereto annexed and made a part hereof, and on which this contract is made, to wit: Twelve hundred and fifty (1,250) feet of completed work and twenty-five hundred (2,500) feet of foundation extension, which shall consist of the foundation extending from the 15-ft. curve at "F" to "D," a length of thirty-seven fifty (3,750) feet, and of the superstructure extending from a point "B" ten hundred (1,000) feet distant from "F" to a point "C," and having a length of twelve hundred and fifty (1,250) feet, said breakwater to be built to the satisfaction and under the direction and personal supervision of the engineer in charge of the works, said engineer to be designated and appointed by the party of the second part. The said parties of the first part shall and will at their own proper cost and expense find and provide all such material, plant, and labor of all kinds whatsoever shall be proper and sufficient for the construction of said breakwater—all for the sum of one hundred and forty-five thousand dollars ($145,000), to be paid as hereinafter stipulated.

Second. The said party of the second part does hereby covenant, promise, and agree to and with the said parties of the first part that he, the said party of the second part, in consideration of the covenants and agreements herein made by the said parties of the first part being strictly executed and performed, will well and truly pay, or cause to be paid, unto the said parties of the first part, their respective heirs, executors, administrators, and assigns, the sum of one hundred and forty-five thousand dollars ($145,000), lawful money of the United States of America, as follows, to wit:

The engineer in charge shall make monthly estimates of the amount of work done during the month, and ninety per cent of the amount of such estimates will be paid for each month to the parties of the first part; and ten per cent of the amount of such estimates shall be retained by the party of the second part until the whole work shall have been completed and accepted within the time aforesaid, when the said amount so retained shall be paid to the said parties of the first part.

Third. It is hereby further understood and agreed by and between the said parties that the said plans and specifications are intended to cooperate, so that any work exhibited in the plans and not mentioned in the specifications, or vice versa, is to be executed the same as if mentioned and set forth in the plans and specifications, to the true intent and meaning of the plans and specifications.

It is distinctly understood and agreed to that the work to be done shall, in any and every event, be delivered in a completed state, and shall accord with the plans and specifications when so delivered, and that any losses or damage from any cause prior to such delivery and acceptance in a completed state shall be at the risk of and shall be immediately made good by the parties of the first part. It is also agreed that the parties of the first part shall not sublet the work without the consent, in writing, of the party of the second part or the engineer in charge.

Fourth. It is agreed and understood that the parties of the first part shall have the free use of all machinery, barges, wharves, houses, and fixtures, formerly used by and now belonging to the Aransas Pass Harbor Company, without cost, charges, or liability for damages resulting from the use of the same.

Fifth. The parties of the first part agree to furnish to the parties of the second part, or to such person or persons designated by the said party of the second part, as shall or may agree to make the said cash payments a good sufficient bond.

Sixth. It is agreed and is made a condition of these presents that time is and shall be of the essence of this contract. And that in case the parties of the first part shall fail to provide sufficient plant, labor, or material to prosecute the work with due diligence, they shall be liable in the sum of one hundred dollars ($100) per day as liquidated damages for each and every day after the 15th day of December, 1895, during which they shall be in default as aforesaid. And that if the said parties of the first part shall continue to be in default as aforesaid for two months after the said last-mentioned date, then, and in that event, the said party of the second part may, in addition to the recovery of the said liquidated damages, take charge of the said work and complete the same, or cause it to be completed, at the risk and cost of the said party of the first part.

In witness whereof the said parties of the first and second parts have hereto set their hands and seals the day and year first above written. (Executed in triplicate.)

—— —— [SEAL.]
—— —— [SEAL.]
—— —— [SEAL.]

Signed, sealed, and delivered in the presence of—

—— ——
—— ——
—— ——

At the instance of Brewster Cameron, and for value received from, we hereby agree to make Charles Clarke & Co. the cash payments, not to exceed in the aggregate the sum of one hundred and forty-five thousand ($145,000) dollars, which are provided for in and when and as the same may become due and payable under the foregoing agreement between the said Charles Clarke & Co. and the said Brewster Cameron.

I, T. B. Wheeler, secretary of the Aransas Pass Harbor Company, do hereby certify that the within and foregoing paper is a true and correct copy of the original it purports to represent.

In testimony of which I hereunto sign my name and affix the seal of the company on this 1st day of Aug., 1897.

[SEAL.] T. B. WHEELER, *Secretary.*

CONTRACTS BETWEEN MESSRS. CHARLES CLARKE & CO. AND ARANSAS PASS HARBOR COMPANY.

This agreement made this, the 6th day of January, 1896, between Charles Clarke and Robert P. Clark, of Galveston, Tex., copartners, under the firm name of Charles Clarke & Co., of the first part, and the Aransas Pass Harbor Company, a corporation organized under the laws of the State of Texas, party of the second part;

Whereas the said harbor company has been recently engaged in the construction of a breakwater 3,750 feet in length, consisting of 1,250 feet of complete breakwater and 2,500 feet of apron extension; and

Whereas the said Charles Clarke & Co. have, under contract date July 3rd, 1895, with Brewster Cameron, of Philadelphia, Penn., constructed or nearly completed the above-mentioned breakwater for the Aransas Pass Harbor Company; and

Whereas the above-mentioned breakwater is only a portion of the entire breakwater proposed to be built, and the said harbor company having signified its intention of continuing the work of building this breakwater, now, therefore, this agreement witnesseth, that for and in consideration of the premises and the sum of five ($5) dollars paid by each of the parties hereto to the other, the receipt of which they do respectively acknowledge, the said parties of the first part and second part hereto, for themselves and their respective heirs, executors, administrators, and assigns, do severally covenant and agree as follows:

First. The said parties of the first part do hereby covenant, promise, and agree to and with the said party of the second part that they, the said parties of the first part, shall and will for the consideration hereinbefore mentioned, begin immediately, and will on or before the 1st day of March, 1896, well and sufficiently build, construct, complete in every respect and deliver in true and thoroughly workmanlike manner to the said party of the second part, one thousand (1,000) feet or more of apron extension, between points D and E, consisting of a mattress foundation thirty (30) feet in width covered by riprap stone forty (40) feet wide and three feet thick, and to deposit riprap stone upon the present apron foundation between the points known as C and D of the breakwater under construction, in such manner as the engineer in charge may prescribe. Said apron extension and building up upon apron foundation to be built to the satisfaction and under the direction and personal supervision of the engineer in charge of the work appointed by the party of the second part.

The said parties of the first part shall and will at their own proper cost and expense find and provide all such material, plant, and labor of all kinds whatsoever as shall be proper and sufficient for the construction of said work at and for the following prices:

For each lineal foot of apron extension, forty feet wide and three feet thick with light mattress foundation, sixteen dollars and twenty-five cents ($16.25).

For each cubic yard of stone deposited upon present foundation, four dollars ($4).

Second. The said party of the second part does hereby covenant, promise, and agree to and with the said parties of the first part that they, the said party of the second part, in consideration of the covenants and agreements herein made by the said parties of the first part being strictly executed and performed, will well and truly pay, or cause to be paid, unto the said parties of the first part, their respective heirs, executors, administrators, and assigns, the sum of sixteen dollars and twenty-five cents ($16.25) for each and every lineal foot of apron extension above mentioned and the sum of four dollars ($4) per cubic yard for each and every cubic yard deposited upon said apron foundation, as follows:

The engineer in charge shall make monthly estimates of the amount of work done during the month, and ninety per cent of the amount of such estimates will be paid for each month, to the parties of the first part; and ten per cent of the amount of such estimates shall be retained by the party of the second part until the whole work contemplated shall have been completed and accepted within the time aforesaid, when the said amounts so retained shall be paid to the said parties of the first part.

Third. It is hereby further understood and agreed by and between the said parties that the plans and specifications heretofore prepared by Prof. Lewis M. Haupt, of Philadelphia, Pa., and H. C. Ripley, of Galveston, Texas, consulting engineers, and used in the construction of the first portion of the breakwater, subject to such modifications as may be agreed upon between the consulting engineers and the engineer who may be in charge of the work, and subject to the direction and control of said engineer, shall form and be made a part of this contract, and that the said plans and specifications are intended to cooperate so that any work exhibited in the plans and not mentioned in the specifications, or vice versa, is to be executed the same as if mentioned and set forth in the plans and specifications to the true intent and meaning of the said plans and specifications.

Fourth. The engineer in charge of the work is to designate in writing to the parties of the first part the extent of the work to be undertaken under this agreement, and it is distinctly understood and agreed that the work to be done shall terminate upon the completion of the specified length of apron extension and the yardage, as determined by the engineer in charge; and that any losses or damages from any cause prior to the delivery and acceptance of the specified work shall be at the risk of and shall be immediately made good by the parties of the first part. It is also agreed that the parties of the first part shall not sublet the work without the written consent of the party of the second part or the engineer in charge.

Fifth. It is agreed and understood that the parties of the first part shall have the free use of all machinery, barges, wharves, houses, and fixtures, formerly used by and now belonging to the Aransas Pass Harbor Company, without cost, charges, or liability for damages resulting from the use of the same.

Sixth. The parties of the first part agree to furnish to the party of the second part a good and sufficient bond.

Seventh. It is agreed and is made a condition of these presents that time is and shall be of the essence of this contract. and that in case the parties of the first part shall fail to provide sufficient plant, labor, or material to prosecute the work with due diligence, they shall be liable in the sum of one hundred ($100) dollars per day as liquidated damages for each and every day after the first day of March, 1896, during which they shall be in default as aforesaid.

And that if the said parties of the first part shall continue to be in default as aforesaid, for one month after the said last mentioned date, then and in that event, the said party of the second part may, in addition to the recovery of the said liquidated damages, take charge of the said work, and complete the same or cause it to be completed at the risk and cost of the said party of the first part.

In witness whereof, the said parties of the first and second parts have hereunto set their hands and seals the day and year first above written. (Executed in triplicate.)

—— —— [SEAL.]
—— —— [SEAL.]
—— —— [SEAL.]

Signed, sealed, and delivered in the presence of—

—— ——
—— ——
—— ——

I, T. B. Wheeler, secretary of the Aransas Pass Harbor Company, do hereby certify that the within and foregoing paper is a true and correct copy of the original it purports to represent.

In testimony of which I hereunto sign my name and affix the seal of the company on this 1st day of August, 1897.

[SEAL.] T. B. WHEELER, *Secretary.*

This agreement, made this the 2nd day of March, 1896, between Charles Clarke and Robert P. Clark, of Galveston, Texas, copartners under the firm name of Charles Clarke & Co., of the first part, and The Aransas Pass Harbor Company, a corporation organized under the laws of the State of Texas, party of the second part.

Whereas the said harbor company has been recently engaged in the construction of a breakwater, 2,900 feet in length, consisting of 1,500 feet of partially completed breakwater and 1,400 feet of apron extension; and

Whereas the said Charles Clarke & Co. have under contract, dated the 6th day of January, 1896, with the said harbor company, constructed and completed the above-mentioned partial breakwater for the Aransas Pass Harbor Company; and

Whereas the above-mentioned breakwater is only a portion of the entire breakwater proposed to be built, and the said harbor company having signified its intention of continuing the work of building this breakwater: Now, therefore, this agreement witnesseth that for and in consideration of the premises and the sum of five ($5) dollars, paid by each of the parties hereto to the other, the receipt of which they do respectively acknowledge, the said parties of the first part and second part hereto, for themselves and their respective heirs, executors, administrators, and assigns, do severally covenant and agree as follows:

First. The said parties of the first part do hereby covenant, promise, and agree to and with the said party of the second part, that they, the said parties of the first part, shall and will for the consideration hereinafter mentioned, begin immediately, and will, on or before the 15th day of April, 1896, well and sufficiently build, construct, complete in every respect, and deliver in true and thoroughly workmanlike manner to the said party of the second part, fifteen hundred feet (1,500) of completed breakwater. between the points C and D, consisting of a core of riprap to be built up to the surface of the water at mean low tide, upon the present apron extension between C and D and upon the partially completed core already laid, and the same to be capped with block stones on the slopes and crest, as per plans and specifications. Said core of riprap stone to be about ten (10) feet in width at the surface of the water when built up and settled, and having side slopes of one and one-half to one foot. The capping to be 10 feet wide at the crest and to be built up 3 feet above the surface of the water at mean low tide, and in such manner as the engineer in charge may prescribe. Said core and capping to be built to the satisfaction and under the direction and personal supervision of the engineer in charge of the work appointed by the party of the second part.

The said parties of the first part shall and will, at their own proper cost and expense, find and provide all such material, plant, and labor of all kinds whatsoever, as shall be proper and sufficient for the construction of said work at and for the following price:

For each cubic yard of stone deposited upon present foundation, four dollars ($4.00).

Second. The said party of the second part does hereby covenant, promise, and agree to and with the said parties of the first part, that they, the said party of the second part, in consideration of the covenants and agreements herein made by the said parties of the first part being strictly executed and performed, will well and truly pay, or cause to be paid to the said parties of the first part, their respective heirs, executors, administrators, and assigns, the sum of four dollars ($4.00) per cubic yard for each and every cubic yard deposited upon the said foundation, as follows:

The engineer in charge shall make monthly estimates of the amount of work done during the month, and ninety per cent of the amount of such estimates will be paid for, each month, to the parties of the first part; and ten per cent of the amount of such estimates shall be retained by the party of the second part until the whole work contemplated shall have been completed and accepted within the time aforesaid, when the said amounts so retained shall be paid to the said parties of the first part.

Third. It is hereby further understood and agreed by and between the said parties, that the plans and specifications heretofore prepared by Professor Lewis M. Haupt, of Philadelphia, Pa., and H. C. Ripley, of Galveston, Texas, consulting engineers, and used in the construction of the first portion of the breakwater, subject to such modifications as may be agreed upon between the consulting engineers and the engineer who may be in charge of the work, and subject to the direction and control of said engineer, shall form and be made a part of this contract and that the said plans and specifications are intended to cooperate, so that any work exhibited in the plans and not mentioned in the specifications, or vice versa, is to be executed the same as if mentioned and set forth in the plans and specifications, to the true intent and meaning of the said plans and specifications.

Fourth. The engineer in charge of the work is to designate in writing to the parties of the first part the extent of the work to be undertaken under this agreement, and it is distinctly understood and agreed that the work to be done shall terminate upon the completion of the breakwater from C to D, as determined by the engineer in charge, and that any losses or damages from any cause, prior to the delivery and acceptance of the specified work, shall be at the risk of and shall be immediately made good by the parties of the first part. It is also agreed that the parties of the first part shall not sublet the work without the written consent of the party of the second part or the engineer in charge.

Fifth. It is agreed and understood that the parties of the first part shall have the free use of all machinery, barges, wharves, houses, and fixtures formerly used by and now belonging to the Aransas Pass Harbor Company without cost, charges, or liability for damages resulting from the use of the same.

Sixth. The parties of the first part agree to furnish to the party of the second part a good and sufficient bond.

Seventh. It is agreed and made a condition of these presents that time is and shall be of the essence of this contract; and that in case the parties of the first part shall fail to provide sufficient plant, labor, or material to prosecute the work with due diligence they shall be liable in the sum of one hundred ($100.00) dollars per day as liquidated damages for each and every day after the fifteenth day of April, 1896, during which they shall be in default as aforesaid.

And that if the said parties of the first part shall continue to be in default as aforesaid for one month after the said last-mentioned date, then, and in that event, the said party of the second part may, in addition to the recovery of said liquidated damages, take charge of the said work and complete the same or cause it to be completed at the risk and cost of the said party of the first part.

In witness whereof the said parties of the first and second parts have hereunto set their hands and seals the day and year first above written. (Executed in triplicate.)

——— ——— [SEAL.]
——— ——— [SEAL.]
——— ——— [SEAL.]

Signed, sealed, and delivered in presence of—

——— ———
——— ———
——— ———

I, T. B. Wheeler, secretary of the Aransas Pass Harbor Company, do hereby certify that the within and foregoing paper is a true and correct copy of the original it purports to represent.

In testimony whereof I hereunto sign my name and affix the seal of the company on this 1st day of August, 1897.

[SEAL.] T. B. WHEELER, *Secretary.*

EXHIBIT G.

CONTRACTS BETWEEN MESSRS. C. P. GOODYEAR AND ARANSAS PASS HARBOR COMPANY.

THE STATE OF MARYLAND, *Baltimore City:*

This contract entered into by and between C. P. Goodyear, party of the first part, hereinafter styled contractor, and the Aransas Pass Harbor Company, a private corporation duly incorporated under the laws of the State of Texas, and having its principal office in the city of San Antonio, Bexar County, Texas, party of the second part, hereinafter styled Harbor Company, witnesseth:

First. That said contractor hereby agrees to construct for said Harbor Company such breakwater, jetties, and other works at Aransas Pass, on the Gulf coast of Texas, as will secure at said pass a permanent, practical, navigable channel over and across the bar at said pass not less than one hundred and fifty feet in width at the bottom and of a continuous depth of not less than twenty feet at mean low tide throughout the length and said width of said channel, from permanent twenty-feet depths of water on the bay side of said bar to permanent twenty-feet depths of water on the Gulf side of said bar, and further agrees to secure for said company a channel of the said length, width, depth, and character and from and to said permanent depths of twenty feet of water aforesaid, and to maintain said channel of the said character and of the said length, width, and depth from and to said permanent depths of twenty feet of water, for one year continuously after he has so obtained same.

Second. Said contractor further agrees to commence the work of securing said channel within sixty days from the signing of this contract, and to procure said channel of said character, length, width, and depth from and to said twenty-feet depths of water within eighteen months from the commencement of the work under this contract, the said time of commencement of work and procurement of said channel being specially made of the essence of this contract.

Third. It is specially understood that the terms of this contract will not be complied with by the obtaining of a dredged or blasted channel only, but that the present incompleted breakwater, built by said Harbor Company at said pass, shall be completed by said contractor in such manner as will make it effective to maintain said channel of said character, length, and width from and to said twenty-feet depths, and such other spurs, jetties, and breakwaters shall be built by said contractor as may be necessary, in his opinion, to secure and maintain the said channel of the character, width, length, and depth aforesaid, the permanency of said works and channel to be determined by the certificate of the engineer hereinafter provided for, or, in case of appeal from his decision, by a certificate of a majority of the Board of Engineers to whom such appeal is taken, as hereinafter provided for.

Fourth. It is further specially understood and agreed that should the said contractor or any subcontractor under him, or any of his employees, or the employees of any of such subcontractors, damage, injure, or destroy, in whole or in part, the breakwater already built at said pass by said Harbor Company, then said contractor, the first party herein, shall immediately rebuild said breakwater or repair said damage or injury thereto at his own cost and expense and without charge, cost or expense to said Harbor Company.

Fifth. It is further specially understood and agreed that said contractor shall begin the work of securing said deep-water channel within sixty days from the signing of this contract as aforesaid, and shall prosecute same with reasonable diligence and dispatch, and should he fail to prosecute same the engineer of the Harbor Company shall give the contractor written notice that in his judgment reasonable diligence is not being used in the prosecution of said work, and if within fifteen days from such notice the contractor has not resumed work, or is not prosecuting it with reasonable diligence, then the engineer of the Harbor Company herein provided for shall so certify, and then said Harbor Company is specially authorized to at once terminate this contract, and all liability of said Harbor Company hereunder shall at once cease, and said Harbor Company shall be in no wise bound or liable to pay for any work said contractor may have done or caused to be done hereunder, nor to pay any of the consideration of this contract, and all works done or erected by said contractor in the prosecution of the work of securing said channel shall become absolute property of said company, and said contractor shall have no right or claim thereto, and he, said contractor, shall at once surrender possession to said company of all of its property and all of the works so done by him, and of all islands or approaches to said pass claimed or owned or now or then occupied by said company. and in addition thereto said contractor shall pay to said company as liquidated damages two thousand dollars per month for each and every month that shall elapse between the signing of this contract and the surrender by said contractor of the aforesaid property and possession. It is further understood, however, that if said contractor is not satisfied with said certificate of said engineer of said company he may, within ten days after he has been notified by said Harbor Company that same has been received by it, and not thereafter, appeal from said decision to a Board of three Engineers, one of whom shall be appointed by said contractor, one by said Harbor Company, and a third by the two chosen, and the decision of a majority of said Board on said appeal shall be final as to both said contractor and said Harbor Company, and if said decision be in favor of said contractor, then this contract shall remain in full force and effect, but if it be in favor of said Harbor Company, then said company may terminate this contract as aforesaid. It is specially understood, however, that the only question to be submitted to said Board is whether said contractor has prosecuted said work of securing said channel with reasonable diligence and dispatch. It is further understood that if said Board decides in favor of said contractor he shall continue the work of securing said channel, and shall pursue same with reasonable diligence and dispatch, subject to all the terms and provisions of this contract. It is further understood and agreed, however, that if said Board decides in favor of said company, and said company terminates this contract, then said contractor shall at once surrender the property and possessions hereinbefore provided for and pay the liquidated damages hereinbefore provided for.

Sixth. It is further understood and agreed that said Harbor Company has the right to appoint a competent riparian engineer to inspect the work said contractor may do in securing and maintaining said channel, and said engineer shall have access to the work at all times, the contractor to supply him with boats and assistants (except assistant engineers) to make surveys or inspections of said work at any time that in said engineer's judgment may be necessary, and said engineer shall make surveys and inspections and prompt report of same for said contractor at any time said contractor may require within fifteen days after notice from said contractor that said survey is desired.

Seventh. It is further agreed and understood that said contractor shall furnish all labor and material of every kind and character whatsoever to secure and maintain said channel, and that all of the work done and material furnished under this contract shall be first class in every respect and shall be and become the property of said Harbor Company upon payment of the consideration herein provided for, or upon the termination of this contract as herein provided for, or upon the failure of said contractor to secure and maintain said channel as herein provided for.

Eighth. Upon full compliance by the said contractor with all the terms and provisions of this contract within the times stipulated herein, and upon the construction of the channel herein provided for by said contractor, and the maintenance of said channel as herein provided for of the depth, width, length, and character as herein provided for continuously for one year after same is constructed, and the depth obtained therein as herein provided for, the length and width herein provided for, then the said Harbor Company will pay to the said contractor the sum of five hundred thousand dollars, of which sum four hundred thousand dollars is to be in cash and one hundred thousand dollars in the first-mortgage bonds of said Harbor Company at their face par value.

It is specially understood, however, that as a condition precedent to his right to certain payment of said money and bonds the said contractor shall obtain from the said engineer of said Harbor Company, after said channel has been so constructed and maintained for a year, a written certificate that said channel has been constructed and maintained as provided for in this contract; and further, that in his, said engineer's, judgment the works done by said contractor are permanent in their character and reasonably suited, in connection with the breakwater already built at said pass at date of signing this contract, for the purpose of continuously maintaining thereafter such channel as provided for under this contract.

But it is further understood that should said engineer fail or refuse to give said certificate, or should certify that said channel has not been constructed or maintained according to this contract, or that the works done by said contractor are not permanent in their character and not reasonably suited, in connection with the breakwater already built at said pass at date of signing this contract, for the purpose of continuously maintaining thereafter such channel as provided for under the contract, then the said contractor shall have the right to appoint one engineer and the Harbor Company shall appoint another, and the two shall appoint a third, and a majority of the three so selected shall decide whether said channel has been constructed and maintained according to this contract, and whether, in their judgment, that the works done by said contractor are permanent in their character and reasonably suited, in connection with the breakwater already built at said pass at date of signing this contract, for the purpose of continuously maintaining thereafter such channel as provided for under this contract, and said decision shall be final between the parties hereto; and should said majority decide that said channel has been constructed and maintained according to this contract, and that in their judgment the works done by said contractor are permanent in their character and reasonably suited, in connection with the breakwater already built at said pass at date of signing of this contract, for the purpose of continuously maintaining thereafter such channels as provided for under this contract, they shall give their certificate in writing to said effect, and then the Harbor Company shall pay said contractor the consideration provided in this contract; but if the majority of said engineers so selected should not decide and should not give and sign said certificate, or if the said engineer of said Harbor Company should not give said certificate, and the contractor not appeal therefrom, then said Harbor Company shall not be bound to pay said consideration or any part of same, and shall not be liable to said contractor in any way for any of the work or labor done or material furnished by said contractor under this contract, and all said labor, material, and work done, constructed, furnished, or erected shall be and remain the property of said Harbor Company: *Provided, however*, That if, notwithstanding the adverse decision of said engineer of the company or the engineers selected as aforesaid, said channel is maintained at said depth of twenty feet for said width and length continuously for one year after said decision, without dredging or other auxiliary aid, but by the works aforesaid, then, at the expiration of said year from said award, said company shall pay said contractor the consideration herein stipulated. It is understood, however, that if during said year said channel is obstructed by extraordinary storms or by wrecks or by other obstructions not resulting from inefficiency of said works, then said contractor shall have the right to remove said obstructions within said year; it being specially understood, however, that possession of all of said works and property shall have been surrendered to said company by said contractor immediately upon rendition of said decision of said engineer or said award of said three engineers.

Ninth. It is further specially understood that none of the provisions of this contract shall be waived, modified, or altered or changed in any way so far as said Harbor Company is concerned, except by resolution of the board of directors of said company duly passed.

Executed in duplicate this the twelfth day of September, 1896.

Witness the signature of said first party, with scroll for seal, and the signature of said second party by its president, duly attested by its secretary.

C. P. GOODYEAR. [SEAL.]
ARANSAS PASS HARBOR COMPANY,
By THOS. H. FRANKLIN, *President.*

Attest:
T. B. WHEELER, *Secretary.*
[SEAL.]

I, T. B. Wheeler, secretary of the Aransas Pass Harbor Company, do hereby certify that the within and foregoing paper is a true and correct copy of the original it purports to represent.

In testimony whereof I hereunto sign my name and affix the seal of the company on this the 1st day of Aug., 1897.

[SEAL.] T. B. WHEELER, *Secretary.*

This supplemental agreement, made this eleventh day of March, A. D. 1897, between C. P. Goodyear, party of the first part, hereinafter styled contractor, and the Aransas Pass Harbor Co., a private corporation, duly incorporated under the laws of the State of Texas, and having its principal office in the city of San Antonio, Bexar County, Texas, party of the second part, hereinafter styled Harbor Company, witnesseth:

Whereas the said contractor and said Harbor Co. did enter into a contract, of date Sept. 12th, A. D. 1896, relating to certain work at Aransas Pass, Texas.

Now, therefore, at the request of the said contractor and in consideration of the premises and of the agreements hereinafter made by him, the said Harbor Company does hereby agree, upon execution of this agreement, to pay to the said contractor the sum of twenty thousand dollars ($20,000) in its bonds as described in the original contract, with coupons attached, of and after date of January 1st, A. D. 1899, at their face, par value, and does further agree, upon the certificate of its engineer appointed by it under the sixth paragraph of the original contract, that a continuous depth of not less than ten feet of water at mean low tide has been obtained throughout the length and width of said channel, as set forth in the first paragraph of the original contract, and that not less than one thousand additional tons of rock of a character equal in quality to that already used in the construction of the northern breakwater has been placed in said northern breakwater, or in lieu of such work on said breakwater that two hundred lineal feet of a south wall, extending from Mustang Island to the wreck of the *Mary*, have been effectively and substantially built and reinforced with rocks of character aforesaid, to pay to the said contractor the sum of ten thousand dollars ($10,000) in its bonds, with coupons attached, of and after date of January 1st, A. D. 1899, at their face value, and upon each further certificate of the said engineer that the continuous depth of said channel at mean low tide has been increased by an additional foot (up to and including total such depth of twenty feet), and that an additional one thousand tons of rock as aforesaid has been placed in said northern breakwater, or in lieu thereof an additional two hundred lineal feet added to the said south wall as aforesaid and reinforced with rock as aforesaid, to pay to the said contractor, upon receipt of each of said certificates, an additional ten thousand dollars ($10,000) in its bonds, with coupons attached, of and after date of January 1st, A. D. 1899, at their face, par value; and

In consideration of the premises and the receipt of said bonds, the said contractor agrees that for each and all payments in said bonds so made to him he will give his receipt for an amount equal to one hundred and thirty-three and a third per cent (133⅓ per cent) of the face par value of such payments of bonds, such receipts to be credited on account of the cash payment coming to him upon his fulfillment of his original contract and his compliance with the condition precedent, set forth in the eighth paragraph thereof, and he further agrees in case of his failure to fulfill his original contract, that then and in such event there shall be due and payable by him to the company, in cash, an amount equal to the face, par value, of all bonds received by him from the company pursuant to the terms of this supplemental agreement.

Executed in duplicate this day and year first above written. Witness the signature of the said first party with scroll for seal, and the signature of the said second party by its president, duly attested by its secretary.

I, T. B. Wheeler, secretary of the Aransas Pass Harbor Company, do hereby certify that the within and foregoing paper is a true and correct copy of the original it purports to represent.

In testimony of which I hereunto sign my name and affix the seal of the company on this the 1st day of August, 1897.

[SEAL.] T. B. WHEELER, *Secretary.*

V II.

MODIFICATION OF HARBOR LINES AT GALVESTON HARBOR, TEXAS.

LAW OFFICE OF MANN & BAKER,
Galveston, July 19, 1897.

SIR: I have the honor to acknowledge the receipt of your letter of the 13th instant. * * *

Additional dock and pier accommodations are absolutely necessary for the utilization of the deep water at Galveston. The proposed development by the West End Dock Company is of the only property owned by the State of Texas, and the only property that is now open to development for dock purposes. All the Galveston Island shore line (except the property the West End Dock Company holds, under the State of Texas) is owned or controlled by the local monopoly wharf company, which stands charged with cost of construction, much of it running back forty years, and whose plant could now be duplicated for one-half its cost, and this monopoly has prevented so far the success of every effort to develop any of the shore line of Galveston Island; and the Pelican Flats, which are on the other or north side of the wharf company's channel, are owned by the city of Galveston, and the city has refused to allow them to be developed for docks, on the ground that there would be an injurious competition to the existing wharf company's interests. In view of this situation, time is of the essence of the matter of developing docks to meet the present wants of commerce at this port. Allow me to most respectfully suggest that a commission meets on Monday, the 26th instant, to pass on the question of a deep-water channel to Houston. If the application of the West End Dock Company could be referred to the members of this commission, with a view of their passing on the mixed question of engineering and commercial necessity that is involved in the question of additional terminal facilities, it would add but little to the labor of these gentlemen, as all local conditions may be presented on a few hours' notice, and if such a reference be impossible, could there be a board appointed by you for this purpose? Or could the matter be referred to Colonel Robert, Division Engineer, as I see from the paper this morning that he will be in Galveston and Houston for some week or more from this date. I take the liberty of inclosing a clipping from the Morning News of an interview with Colonel Robert, which shows that he is advised of the situation as to there not being such terminals as are necessary for the increasing wants of this port, growing out of deep water.

You make reference in your letter to the fact that the harbor lines were established at the request of a committee appointed by the Galveston chamber of commerce and approved by the chamber of commerce. I am vice-president of the Chamber of Commerce of Galveston, and I am delegate at large for the State of Texas on the deep-water utilization committee, representing twelve States. I was chairman of the committee of the chamber of commerce and drafted the request for the harbor lines; matters were in so crude a state when this request was made that we then deemed it best, and I still think wisely, to so put the harbor lines that all the work that might be necessitated by the wants of commerce should have the approval of the War Department, and we only ask now for such a general consideration of the subject as will decide whether the encroachment on the tidal basin, as reported by the local engineer officer, would be so serious as to overcome the present needs of commerce for additional docks and piers.

Of course, there can never be an additional pier that would not be such an encroachment, but if there are to be no additional piers the work of the General Government has been of little avail for the wants of commerce, as the 2½ miles, representing the present piers, are utterly inadequate to the present wants of commerce. I am the organizer of the West End Dock Company, and its main aim and object is the furtherance of the utilization of deep water. My interest in it has been shown by my work on the deep water utilization committee and in the Galveston Chamber of Commerce. The interest that I feel in the utilization of the deep water of the States that I represent in the deep-water utilization committee, will excuse me if I have in this letter presented this matter in a way that will be considered informal, or if my suggestions to speed the work have been such that, for any reason, they can not meet your official sanction.

With great respect,

G. E. MANN,
Prest. W. E. Dock.

Hon. R. A. ALGER,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 28, 1897.

Respectfully referred to Col. Henry M. Robert, Corps of Engineers, Division Engineer, Southwest Division.

If these papers reach Colonel Robert while he is in Galveston or vicinity, it is requested that he investigate the matter and submit his views and recommendations for the information of the Secretary of War.

A. MACKENZIE,
Acting Chief of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE, SOUTHWEST DIVISION,
New York, September 18, 1897.

Respectfully returned to the Chief of Engineers, U. S. Army, inviting attention to the accompanying report.

HENRY M. ROBERT,
Colonel, Corps of Engineers, Division Engineer.

REPORT OF COL. HENRY M. ROBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
NORTHWEST DIVISION,
New York City, September 18, 1897.

GENERAL: In compliance with instructions contained in your indorsement of July 28, 1897, on the letter of Mr. George E. Mann, president of the West End Dock, dated Galveston, July 19, 1897, relative to change of harbor lines at Galveston, I have the honor to submit the following report:

While at Galveston the early part of last August, I was enabled to examine into this matter, and to have interviews with several parties in relation thereto, including Judge George E. Mann, the president of the West End Dock, Mr. George M. Courts, president chamber of commerce, Mr. E. A. Hawkins, attorney for the city company, which company I understand originally owned the city site and now owns all the land available for docks except what is owned by the wharf company and the Santa Fe Railroad Company. Mr. H. B. Cullum, chairman of the Galveston subcommittee of the deep-water utilization committee, the object of which is shown in inclosure 9 of the papers referred to me, and Mr. M. H. Méron, the French consul, who has very thoroughly studied up all the commercial interests of Texas and is just leaving the State.

The city company claims a part of the land that would come within the proposed extension of the dock line and objects to having any of its property taken from the company. I explained to the attorney that if the Secretary of War extended the dock line, it would in no way affect their title to the land that might thus be reclaimed, that the State laws would settle the question of ownership.

From all I learned I am fully satisfied that the commercial interests of Galveston would be subserved by granting the extension of the dock line asked for, provided no serious injury is done thereby to the channel.

The entire area taken from the bay by the proposed extension of the harbor lines is less than 1 square mile, and about two-thirds of this will be filled in, so that the tidal basin will be diminished about two thirds of 1 square mile. The tidal basin covers over 450 square miles, so that the proposed diminution of this basin amounts to less than one-sixth of 1 per cent. The place to be filled is over 12 miles from the entrance to the harbor, and therefore the filling would have scarcely an appreciable effect upon the tidal prism. Assuming that it would increase the amount of dredging by one-sixth of 1 per cent, and that 600,000 cubic yards of material would have to be dredged annually to maintain the ship channel (and I think no one would put it so high), then this extension of the harbor lines would require 1,000 cubic yards of extra dredging annually at a cost of not to exceed $70.

I am required by my instructions to submit my "views and recommendations for the information of the Secretary of War."

It seems to me that the General Government should interfere with local interests only when absolutely necessary to protect more important public interests. Every pier built into a harbor interferes somewhat with the tidal basin or currents, but in most of our harbors the benefits resulting from the construction of these piers outweigh the disadvantage. A harbor is of little value to commerce unless citizens are permitted to build piers and wharves, and in some cases to fill up shoals and extend islands. Galveston Harbor is an instance of this itself. Its present wharf front is totally inadequate to the wants of a great commercial port, such as should be created at this point. The entrance to this harbor is now the finest south of Norfolk, but its dock room is not enough for a second-class port. The Secretary of War has established harbor lines around Pelican shoals, allowing several miles of filling, but even with this the supply will be small, and it seems to me that the United States should not prevent the effort of citizens to extend their commercial facilities when there is no serious interference with public interests resulting therefrom. With the riparian questions involved it seems to me the United States has nothing to do. The State laws are ample to protect all parties concerned. The United States does not give the right to any corporation or individual. The United States simply says that as far as it is concerned it is willing to have the harbor line extended to certain limits. It withdraws its hands from certain territory and allows local laws full sway.

I would therefore recommend that the extension of the harbor lines requested by the West End Dock be granted, and that the description of the Galveston Harbor lines as given in the report of the Chief of Engineers for 1896, page 1564, under "Galveston Channel," be modified by striking out everything after the word "boundary" on next to last line of paragraph, and inserting the following:

Thence N. 76° 18′ W., 3,750 feet; thence S. 73° 17′ W., 9,750 feet; thence S. 30° 22′ 30″ W., 5,564 feet to the Galveston, La Porte and Houston Railway bridge over West Bay.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Colonel, Corps of Engineers,
Division Engineer Southwest Division.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers.

NOTE.—The papers were returned to the Secretary of War by the Chief of Engineers September 23, 1897, concurring in the views of Colonel Robert, and recommending approval of the changes proposed by him.

The modified lines were approved by the Secretary of War September 25, 1897.

APPENDIX W.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, TEXAS, ARKANSAS, AND MISSISSIPPI, TRIBUTARY TO MISSISSIPPI RIVER; WATER GAUGES ON MISSISSIPPI RIVER AND ITS PRINCIPAL TRIBUTARIES.

REPORT OF MAJ. J. H. WILLARD, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Red River, Louisiana and Arkansas.
2. Red River above Fulton, Arkansas.
3. Cypress Bayou, Texas and Louisiana.
4. Ouachita and Black Rivers, Arkansas and Louisiana.
5. Bayou Bartholomew, Louisiana and Arkansas.
6. Bœuf River, Louisiana.
7. Tensas River and Bayou Maçon, Louisiana.
8. Yazoo River, Mississippi.
9. Mouth of Yazoo River and harbor at Vicksburg, Mississippi.
10. Tallahatchie River, Mississippi.
11. Big Sunflower River, Mississippi.
12. Water gauges on Mississippi River and its principal tributaries.

United States Engineer Office,
Vicksburg, Miss., July 1, 1898.

General: I have the honor to transmit herewith annual reports upon works of river improvement in my charge for the fiscal year ending June 30, 1898.

Very respectfully, your obedient servant,

J. H. Willard,
Major, Corps of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

W 1.

IMPROVEMENT OF RED RIVER, LOUISIANA AND ARKANSAS.

Operations during the fiscal year ending June 30, 1898, for general improvement of Red River between Fulton, Ark., and the head of Atchafalaya River, Louisiana, a distance of 508.6 miles, were continued by the U. S. snag boat *C. W. Howell*, assisted below Alexandria, La., during the period of lowest water by the U. S. snag boat *O. G. Wagner*.

Details of the work done are as follows:

The U. S. snag boat *C. W. Howell*, M. B. Lydon, master, shipped a crew, took supplies and fuel aboard at Shreveport, La., and left for below at 2 p. m., July 2, 1897. The U. S. snag boat *John R. Meigs*, with the dredge to be used in Cypress Bayou in tow, was met on the 3d a short distance above Coushatta, and the *Howell* rounded to and aided in towing the dredge to Shreveport, reaching that place the afternoon of July 5. July 6 to 10 the *Howell* was employed between Shreveport and Uni, La., 32 miles above, but returned to Shreveport the latter date for repairs of capstan machinery. Having made temporary repairs, the boat returned to the old-raft region July 12, where it was employed the remainder of that week, operations extending upstream to Kountz Canal, 59 miles above Shreveport. In addition to snagging operations, hard-clay points, which were causing opposite banks to cave, and endangering levees, were blasted at several places. The boat returned to Shreveport Sunday, July 18, and July 20–24 made a trip over the stretch between Shreveport and Golddust, 28 miles below, removing all obstructions that could be located.

I visited Shreveport July 25 for the purpose of inspecting the change in the channel at that place, and to direct future operations of the snag boat *Howell*. I found a very marked change in the course of the river at Shreveport, due chiefly to the cutting off of the supply of water that formerly came out of Cross Bayou from the lakes on right bank between Blanton Bluff and Shreveport. Since the removal of the great raft, repeated work on the bottom of the river by snag boats has helped the scour, and the closing of outlets along the right bank has confined more and more of the flood water to the main channel. In 1897 there was no very high stage of Upper Red River; and Cross Bayou, which was closing from natural causes, had been embanked to provide water for the city. The current out of Cross Bayou used to force that of Red River toward the Bossier or left bank, but now Red River bends in toward the Shreveport side, was cutting into the old batture in front of the city, and the channel was moving from the draw span westwardly under the fixed spans of the railroad bridge. As these conditions would have prevailed if the bridge were not there, the railroad company and the parishes operating the bridge could not be held responsible for them. With that view, work was ordered at once to force the current toward the draw span. A wing dam had been built by the United States several years ago, when the channel showed a similar tendency, and some of the work was still in place. The master of the *Howell* was directed to repair and extend it shoreward and toward the draw pier, and this work was completed by the crew of the snag boat August 7. Upon sounding the latter date, it was found that the channel depth through the draw opening had scoured to 4½ to 5 feet, where there had been but 2 feet at same stage before the dam was rebuilt and extended.

The pile driver was taken down, and at 9 a. m., August 9, the snag boat *Howell* left for work in the lower river. A list of obstructions was obtained from the master of the commercial steamer *W. T. Scovell*, special attention to removal of which was given on the way down. August 21–26 were spent in building a pile and brush wing dam, 462 feet long, at the wreck of the steamer *C. E. Satterlee* (sunk 1893) at Gainnie Point, Rock River Bend, which connected with head of the wreck and closed the left chute. The steamer *H. W. Graves* grounded on this bar for 48 hours August 17, 18, but on a trip to Campti, after the dam was completed, her master reported good depth of channel. At Tessier Bar, where the water was very shoal the preceding low-water season, not less than 5 feet depth was found, and the dam built in 1896 was holding well. Good depth was found on Cockfield Bar (a new formation at the lower end of Prudhomme Bar), and the channel at that locality was cleared of logs and snags August 28–30. The steamer *H. W. Graves*, aground on Colfax Bar, was pulled off August 30, and August 31 the *Howell* reached Alexandria, passing the bridge and Upper Falls on a stage of 0.5 foot below zero on Alexandria gauge without difficulty. Supplies were taken aboard at Alexandria, and work was continued downstream to Midway, 38.3 miles below Alexandria and 248.5 miles from Shreveport. A wing dam, 397 feet long, was built at Snaggy Point Bar, and one 224 feet long was built at Midway Bar. After a consultation with the officers of the steamer *City of Little Rock*, the only commercial boat running at the time, and at their request, the master of the *Howell* turned the boat back at Midway and commenced working upstream. A wing dam, 425 feet long, was built at Stonewall Bar; Poland Cut-off was cleared of obstructions, and a hard-clay point blasted at the upper end, and the boat returned to Alexandria September 18. Yellow fever having broken out at New Orleans after the *Howell* passed down, a strict quarantine was found in force at Alexandria, and the boat was not allowed to land until September 20, when permission was obtained for the master to go ashore to purchase sufficient subsistence stores to continue upstream. September 21–23 were spent in building a wing dam 582 feet long at the bar a short distance above Alexandria, where there was only 18 inches depth, and from the 24th to the 29th two dams, aggregating 800 feet in length, were built at Swilly Bar, 6 miles above Alexandria. By that time Red River had reached a stage near extreme low water, which continued throughout October and November, and the greater part of December. It frequently was necessary for the *Howell* to back and scour a channel with her wheel as she proceeded upstream. In doing this the wheel frequently would strike unseen stumps and logs difficult to remove, as there was not space for the vessel to turn. At St. Andre and Prudhomme bars the channel had changed so much that construction of wing dams was necessary. Cockfield Bar, a place there had been no difficulty in crossing at former periods of low water, had but 2 feet depth upon it and was strewn with log piles. While removing the logs, October 29, the *Howell* ran on a snag and raked a hole through her bottom about 15 feet long. The leak was battened, compartments pumped out, and temporary repairs completed, and snagging operations were resumed the following day. The *Howell* was built in 1881, and has not been in dock during the seventeen years since. Owing to the worn condition of her iron bottom, the boat has met with similar accidents on several occasions of late years, but has lost little time from active service thereby. Prompt temporary repairs were made by a master equal to such emergencies, and iron patches were fitted and riveted over the holes under his direction at Shreveport or Fulton, by use of inexpensive sectional docks, after the boat was laid up at high stages. A wooden boat would have been lost long ago, and if recovered would have been hauled out and rebuilt time after time; the nearest dock being at New Orleans, anywhere from 300 to 800 miles distant, according to the point of operations. In addition to the difficulties caused by low stages, work was impeded the latter part of the summer by sickness among the crew, the inability to procure medicines and supplies on account of yellow fever quarantines, and the necessity of cutting the greater part of the wood required for fuel; little being on the banks for sale on account of suspension of navigation from New Orleans, and in some cases where it was out the crew was forbidden to come ashore by the quarantine guards. Occasionally, in crossing long bars, fuel had to be cut and boated considerable distances in yawls.

A slight rise set in December 8, sufficient to permit the *Howell* to work to greater advantage, and without delay in crossing bars. A drift pile opposite Star Point was removed January 1, 1898, containing 12 snags, 43 logs, and 3 stumps. More or less work upon this obstruction had been done each trip of the snag boat for several years, but the formation of a bar on the opposite side of the river kept forcing the channel into the logs. This time they were removed thoroughly, so that the channel should not be closed to navigation at low stages.

The *Howell* reached Shreveport January 9, and remained for three days undergoing repairs of boiler, etc. January 13–26 work was continued to upper end of Red Bayou Levee, 53 miles above Shreveport, built by the United States in 1895–96. Upon examination, the levee was found to be well protected by a thick growth of Bermuda grass and in good condition, except that a strong current running in Rattling Slough last high stage had washed the cane mattress built to protect the end of the levee the latter part of March, 1897. At the time this mattress was made the river was rising, the stage already high, and the ground saturated. Conditions being more favorable, it was repaired as thoroughly as practicable with the material at hand, and probably will be strong enough to resist any current striking it. January 27 operations were continued up to Missionary, near the Arkansas and Louisiana line, 69 miles above Shreveport, and thence back to Shreveport, the boat reaching that city January 29. At Shreveport repairs of the iron bottom were commenced without delay. The sectional dock, used for the purpose before, was altered and repaired, sunk under the snag boat, and pumped out. Four iron patches were fitted, drilled, riveted in place, and painted, after which the dock was removed.

February 18 work in the river above Shreveport was resumed. Sunday, February 20, while lying at Uni, La., an urgent appeal for help was received from the steamer *Linda*, which had struck a floating log at Douglas Place, about 13 miles below. The *Howell* went to the wrecked vessel as soon as steam could be raised, and found her sunk with head out in about 20 feet of water and stern in 10. After several attempts the boat was raised February 23 and towed to Shreveport. February 24 to March 8 work of the *Howell* was carried up to Garland, Ark., 130 miles above Shreveport. As the stage at the time was low and falling it was not considered advisable to continue above Garland, by pulling over numerous bars, and March 9–14 the boat worked back to Shreveport. A slight rise having set in, the *Howell* worked from Shreveport to Fulton March 15–21, and continued above. The report of operations above Fulton, Ark., is given under that head.

May 19–22 the *Howell* was employed in removing drift, etc., to prevent raft formation and danger to levees by cross currents cutting into the banks, caused by side jams.

June 10–11 Col. H. M. Robert, Corps of Engineers, Division Engineer, and myself, accompanied by Assistant State Engineer of Louisiana F. M. Kerr and Assistant Engineer H. M. Marshall, of this office, made an inspection of the river upon the *Howell* from Shreveport to Knox Point, La., and return, over the stretch known as the Little River.

The following is a summary of the work done by the *Howell* in Red River, between Fulton, Ark., and Midway, La., during the year, viz:

Snags pulled	2,027
Stumps pulled	464
Shore snags cut	3,010
Logs removed from channel	4,020
Side jams removed	21
Hard clay points blasted	16
Leaning trees cut	203
Square yards of willows and brush cut	350
Linear feet pile and brush dams built	3,719
Square yards of cane mattress built at upper end of Red Bayou Levee	500

The U. S. snag boat *O. G. Wagner*, Watkins Decker, master, was employed between the mouth of Black River and Alexandria, La., November 1, 1897, to January 18, 1898. Low water in November afforded a favorable opportunity for destroying obstructions to navigation, the stages having been 2 to 2½ feet lower than when this stretch was worked over by the *Wagner* in 1896, disclosing many snags and stumps passed over at that time. The boat had no trouble on account of shoal water, 3½ feet having been the least depth found, but, on account of the swift current, lines had to be laid several times while working around Grand Point, and once in the Rapions, to pull between mud lumps where the channel was narrow. Around Grand Point stumps and snags were removed from the channel and from mud lumps wherever dangerous. At "The Funnel," a very narrow place, their removal widened the channel about 10 feet. A badly obstructed reach above Natchitoches Bayou to Lake Long was thoroughly cleared of obstructions. The Rapions and the bend below were worked over with care. Also the reach in front of and above Murry Place. A heavy tree slide was destroyed at Lenoir Point, and Little Prairie Bend was freed of obstructions.

Stormy weather, followed by two local rises, impeded work somewhat in December. Continuous rains December 1–4 caused a rise of about 12 feet, which commenced falling December 7. December 17–27 there was a second rise of about 15 feet, which stopped the removal of channel obstructions for a time. While the stages were high operations were directed to the removal of shore snags and trees and stumps in danger of caving or sliding into the river. Notably bad bends were cleared of this class of obstructions as follows: Persimmon, above and below Saline Bayou, Negro Point and Bends, bend above Confederate Dam, bend below Wares, Coco, above and below P. J. Laborde, Times, Berlin, Cassandria, Choctaw, and Guillottes. With a rapid current it is difficult to keep a loaded boat out of the bends in stormy weather, and this work will save much damage to upper works of steamboats. The stages were low the early part of January, and effective work for the removal of snags, stumps, etc, in the channel was accomplished at Glover Bar, Egg Bend, above and below Grimes Bluff, above, below, and in Wilson Cut-off, and above and below Poland Landing. In addition to the removal of channel obstructions, all those along shore—shore snags, trees ready to slide, stumps, etc.—were destroyed or moved to places where they could not get into the channel.

Continued rains set in January 12, and by the 18th the river had reached a stage too high for continuing work to advantage, and upon reaching Alexandria the *Wagner* was laid up with the plant at that place.

The following is a summary of the work done by the *Wagner* November 1 to January 18, viz:

Snags pulled	719
Stumps pulled	622
Stumps cut	213
Shore snags cut	149
Logs cut up	14
Leaning trees cut	46

ALEXANDRIA.

Early in July, 1897, upon the approach of low water, the plant at Alexandria, La., was put in readiness to resume work. The barges were repaired and calked, the dipper and handle were shipped on the U. S. dredge *Lone Star*, and the plant was towed to the Upper Falls

July 11 by the U. S. snag boat *Columbia*, which had been transferred to Alexandria from Ouachita River.

Dredging operations for widening and straightening the cut through the Upper Falls were resumed July 15, and continued until September 29, 1897, when the available funds ran out. The following is a summary of the work done:

Cubic yards of rock excavated from channel	8,089
Number of barge loads moved to and deposited along west bank	382

The season's operations completed the project for work at Alexandria, and provided a wide and straight channel, which has been excavated to a depth of 6 feet below low water of 1896 (9.3 feet below zero of the Alexandria gauge), except in the last cut made on the Pineville side, where in a few spots there is 1 foot less water.

CONSTRUCTION OF LEVEES.

No levee work was undertaken by the United States during the year, for reasons given in my last report (pp. 1885–1887, Report Chief of Engineers, 1897), and because no additional appropriation was made.

A statement of the work done by the State of Louisiana, furnished by the Board of State Engineers, is appended hereto.

Under provisions of river and harbor acts of 1892 and 1894, a plan for improvement of Red River was authorized to include "construction of a substantial system of levees to restrain the greatest floods, either alone or in partnership with the riparian States," for the purpose of confining the river to the adopted channel, thereby improving and giving ease and safety to navigation. This system was begun by the United States in 1892 in conjunction with the State of Louisiana and local levee districts, and it has been the endeavor to put the levees built or enlarged up to a grade about 3 feet above the highest flood of record. The total work done is shown in the following table:

Statement of levee work on Red River built by the United States since 1892.

Fiscal year.	Miles of new work.	Miles of enlargement.	Cubic yards built.	Cost.
1893	3.60		324,323	$48,631.73
1894		1.16	21,000	4,788.00
1895	2.55		261,455	37,623.44
1896	2.60	4.58	354,721	48,996.16
Total	8.75	5.74	961,499	140,039.33

Statement of levee work on Red River built by the State of Louisiana and local levee districts since 1892.

Fiscal year.	Miles of new work.	Miles of enlargement.	Cubic yards built.	Cost.
1893	58.80	12.80	2,921,765	$503,021.73
1894	12.00	25.00	1,095,789	136,086.22
1895	20.20	13.10	973,867	122,478.16
1896	5.21	13.83	482,411	57,226.59
1897	5.31	15.23	536,988	47,820.77
1898	6.01	2.34	371,914	42,185.39
Total	107.53	82.30	6,382,734	908,818.86

The work of the United States is part of a system to improve navigation, and that of the State engineers and the levee boards is for protection of fertile lands from overflow. But while the work done by the United States is a comparatively small percentage of the whole, it has served to direct action of the State engineers in planning their portions of the system to no small extent, and if operations could be continued in the same way for a few years the levee lines within Caddo and Bossier districts would be completed at a relatively moderate charge to the United States. The people of those districts, however, have taxed themselves for levees almost to impoverishment, anticipating revenues of future years to push the work, and their means are exhausted for the present.

Three levee districts along Red River have been created by acts of the Louisiana legislature, viz:

1. The Caddo Levee district, including alluvial lands subject to overflow from Red River, its tributaries and outlets in the parish of Caddo, created by act No. 74, approved July 6, 1892.
2. The Bossier Levee district, embracing the alluvial lands subject to overflow from Red River and its tributaries or outlets within certain limits of Bossier Parish, created by act No. 89, approved July 6, 1892.
3. The Red River, Atchafalaya, and Bayou Bœuf Levee district, created by act No. 79, approved July 5, 1890, includes territory subject to overflow from Red River, Bayou des Glaizes, and Atchafalaya River in Rapides, Avoyelles, and part of St. Landry parishes.

As yet there are no organized districts for the stretch below the Caddo and Bossier districts to Rapides Parish.

All the work done by the United States is within the Caddo and Bossier districts, except a short stretch required to connect the line above the Sale and Murphy dam with the hills in Arkansas.

The condition of the levee system was summarized in my report for 1896 (Report Chief of Engineers, 1896, pp. 1579–1580), to which should be added the work completed by the State of Louisiana since, as given in subsequent reports.

Statement showing levee work on Red River undertaken by the State of Louisiana from July 1, 1897, to June 30, 1898.

[Prepared by request for Maj. J. H. Willard, Corps of Engineers.]

Name of contract.	Parish.	Below Fulton.	Date of—		New levee.	Enlargement.	Quantity.	Price per cubic yard.	Cost.	Per cent of work done.
			Contract.	Final certificate.						
Caddo Levee district.		*Miles.*			*Linear feet.*	*Linear feet.*	*Cubic yards.*	*Cents.*		
Logie Lea	Caddo	221.5 -222.75	Sept. 25, 1897	May 28, 1898	5,278		81,327	12.9	$12,369.94	100
Pascagoula section	do	216.5	do	do	1,200		6,307			
Long Point section	do	210.75	do	do	1,080		8,257			
Total					7,558		95,891		12,369.94	
Bossier Levee district.										
Cash Point	Bossier	173.75-175	Sept. 21, 1897	May 28, 1898	3,750		37,401	12.99	20,382.71	100
Jetter section	do	181.5 -182.75	do	do	5,843	870	57,671			
Colquitt Point section	do	182.75-183.75	do	do	1,265	3,854	17,265			
Gilmer Lane section	do	183.75-184.5	do	do	4,445		44,574			
Fullilove	do	192 -192.75	Mar. 19, 1898	do	3,996		37,119	6	3,344.40	100
Nicholson section	do	193.5	do	do	1,997		18,621			
Total					21,296	4,724	212,651		23,727.11	
Red River, Atchafalaya and Bayou Bœuf Levee district.										
Belleview	Rapides	399.5 -400.5	June 23, 1897	Sept. 9, 1897	3,548	1,180	44,699	8.19	3,660.85	100
Slocum	do	409.75	Sept. 6, 1897	Dec. 31, 1897		1,962	6,754	13	2,427.49	100
Beaver Dam	do	415 -415.5	do	do		4,473	11,919			
Total					3,548	7,615	63,372		6,088.34	
Total work undertaken during year					32,402 (6.01 miles.)	12,339 (2.34 miles.)	371,914		42,185.39	

The Caddo and Bossier Levee districts, owing to the large expenditures incurred for levee work in the districts from 1892 to 1896, necessitating the anticipation of the revenues of future years, have not since been able to enter into any expenses beyond those required for administration.

In the Red River, Atchafalaya and Bayou Bœuf Levee district, the State, in addition to the work done on Red River, shown above, during the same period raised and enlarged levees on the Atchafalaya River amounting to 71,039 cubic yards, costing $8,427.72, and the district undertook and has just about completed a line of levee on Bayou des Glaizes 55,720 feet in length, amounting to 232,866 cubic yards, and costing $19,211.45. This district also was compelled to expend some $22,000 in the protection of the lower part of the district from overflow during the high water of 1897.

Very respectfully,

THE BOARD OF STATE ENGINEERS,
Per F. M. KERR, *Assistant State Engineer.*

OFFICE BOARD OF STATE ENGINEERS, *New Orleans, La., June 14, 1898.*

SULPHUR RIVER.

No work for improvement of this tributary of Red River was done during the year.

There is a balance of $2,601.01 from the allotment provided for its improvement by river and harbor act of August 18, 1894, from the appropriation for improving Red River, but it can not be expended advantageously except during the period of lowest water, and at that time in the past year the entire plant and available force were employed on more important work.

At present navigation of Sulphur River is confined to timber rafts and flatboats.

During the approaching low-water season it is intended to organize a party to work from the Texarkana and Fort Smith Railroad bridge to the mouth, removing stumps, snags, and leaning trees which may obstruct navigation.

ESTIMATES.

Additions to plant	$50,000
Care of plant and ordinary repairs	15,000
New bottom for snag boat *Howell*	10,000
New bottom for snag boat *Florence*	5,000
Service of plant, snag boats, etc	50,000
Levees	550,000
Local surveys, maps, and gauges	10,000
Administration and contingencies	5,000
Continuing snagging operations, etc., above Fulton	5,000
Total	700,000

Money statement.

July 1, 1897, balance unexpended	$100,023.61
June 30, 1898, amount expended during fiscal year	25,497.84
July 1, 1898, balance unexpended	74,525.77
July 1, 1898, outstanding liabilities	36.97
July 1, 1898, balance available	74,488.80
Amount that can be profitably expended in fiscal year ending June 30, 1900	700,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The amounts expended during the year and balances July 1, 1898, are as follows:

Allotments.	Expended during year.	Balances July 1, 1898.
For general improvement, repairs, care of plant, etc	$18,616.16	$1,788.78
For Little River from Scopini Cut-off to Knox Point (act September 19, 1890)	2,292.31	7,708.41
For work at Alexandria	3,574.25	....
For construction of levees	955.12	62,427.57
For Sulphur River	60.00	2,601.01
Total	25,497.84	74,525.77

The appropriations for the early work, from 1828 to 1852, were as follows:

Date of act.	General object of appropriation.	Amount.
May 23, 1828	Improving navigation of Red River through or around the raft in Louisiana and Arkansas	$25,000.00
Mar. 2, 1831	Arrearage due Major Burch for survey of raft of Red River, Louisiana	187.50
July 3, 1832	Improving navigation of Red River, Louisiana and Arkansas, being balance of appropriation of 1828 carried to surplus fund, and the further sum of $20,000	22,628.00
June 28, 1834	Improving navigation of Red River	50,000.00
Mar. 3, 1835	Completing removal of obstructions to navigation of Red River	50,000.00
July 2, 1836	Continuing the removal of obstructions in Red River	40,800.00
	Constructing a boat to prevent a new accumulation of obstructions in Red River within the old limits of the great raft, $15,000, and to work and support same, $15,000	30,000.00
Mar. 3, 1837	Continuing the removal of obstructions in Red River	65,000.00
Apr. 20, 1838	The complete removal of the great raft in Red River	70,000.00
Mar. 3, 1841	Removing the raft of Red River	75,000.00
Mar. 2, 1847	Deficiency of appropriation by act of April 20, 1838, being amount advanced by Daniel T. Witlee and others through the branch of the Real Estate Bank of Washington, Ark., to Henry M. Shreve, Government agent, for removal of great raft, and expended by him for that purpose	7,150.00
Aug. 30, 1852	Removing the raft of Red River	100,000.00
	Aggregate of appropriations, 1828–1852	535,765.50
	Amount expended	532,219.90
	Amount carried to surplus fund	3,545.60

The appropriations since 1872 have been as follows:

Date of act.	General object of appropriation.	Amount.
June 10, 1872	Improvement of Tones Bayou, Louisiana	$20,000
	Removing the raft in Red River, Louisiana	150,000
Mar. 3, 1873	do	80,000
June 23, 1874	do	50,000
Mar. 3, 1875	do	20,000
Aug. 14, 1876	Removing the raft in Red River and closing Tones Bayou	35,000
Apr. 10, 1869	Allotment made August 27, 1877, for closing Tones Bayou	4,500
Feb. 7, 1878	Opening navigation of Red River above Shreveport, La., and keeping same open and free from rafts, and for the purpose of preserving vessels of the United States employed in that work	6,000
June 18, 1878	Removing raft in Red River and closing Tones Bayou	24,000
	Removing snags and other obstructions from Red River	25,000
Mar. 3, 1879	Removing raft in Red River and closing Tones Bayou	15,000
	Removing obstructions from Red River	22,500
	Improving upper Red River, Arkansas, from Fulton to head of the raft	10,000
June 14, 1880	Removing raft in Red River and closing Tones Bayou	25,000
	Removing obstructions from Red River, Louisiana, including construction of snag boat	60,000
	Improving upper Red River, Arkansas, from Fulton to head of the raft	10,000
Mar. 3, 1881	Removing raft in Red River and closing Tones Bayou	10,000
	Removing obstructions from Red River, Louisiana	10,000
Aug. 2, 1882	Continuing improvements from the Atchafalaya to Fulton, Ark., including Bayou Pierre, Tones Bayou, and to relieve the town of Alexandria from encroachments of the river	75,000
July 5, 1884	Continuing improvement from the Atchafalaya to Fulton, Ark.; not exceeding $15,000 for revetment to protect the harbor at Alexandria from damage by the current of river; not exceeding $5,000 to close the outlet known as Sale and Murphy Canal; the remainder to be applied to improvement of the main channel of the river	75,000
Aug. 5, 1886	Continuing improvement from Fulton, Ark., to the Atchafalaya River, Louisiana, including completing the work at Alexandria; $25,000, or so much thereof as necessary, to be used in making a thorough survey of the river from Fulton to the Atchafalaya, and in completing survey of Bayou Pierre, Louisiana	75,000
Aug. 11, 1888	Continuing improvement from Fulton, Ark., to the Atchafalaya River, including completing the work at Alexandria; $5,000, or so much thereof as necessary, to be used upon Cypress Bayou and the lakes between Shreveport, La., and Jefferson, Tex., and $5,000, or so much thereof as necessary, upon Bayou Dorcheat	65,000
	Completion of survey from Fulton, Ark., to the Atchafalaya River	35,000
Sept. 19, 1890	Continuing improvement from Fulton, Ark., to the Atchafalaya River; $15,000 to be used in the work at Alexandria; $20,000 to be used in deepening and widening that portion known as Little River, from the Scopini Cut-off to Knox Point, and $5,000 in closing the Sale and Murphy Outlet	100,000
	Completion of survey from Fulton, Ark., to the Atchafalaya River	28,000

Date of act.	General object of appropriation.	Amount.
July 13, 1892	Continuing improvement from Fulton, Ark., to the Atchafalaya River, according to plan of Capt. J. H. Willard, Corps of Engineers, and for completion of survey, including the work at Alexandria, the widening of that portion known as Little River, the necessary work at the harbor at Shreveport, the closing of outlets on the west bank of the river above Shreveport, and the removal of the towhead just above Rush Point, Caddo Parish (of which $5,000 may be used, in the discretion of the Secretary of War, for work in Cypress Bayou and the lakes between Shreveport, La., and Jefferson, Tex.)	$145,000
Aug. 18, 1894	Continuing improvement from Fulton, Ark., to Atchafalaya River, according to plan of Capt. J. H. Willard, Corps of Engineers, and for completion of survey; $15,000, or so much thereof as necessary, to be used in further prosecution of work at Alexandria, and $5,000 for improving Sulphur River, a tributary of Red River	150,000
June 3, 1896	Continuing improvement from Fulton, Ark., to Atchafalaya River	100,000
	Aggregate appropriations, 1872 to 1898	1,425,000

COMMERCIAL STATISTICS.

The river was reported navigable in the fiscal year as follows: From Shreveport to Fulton for light-draft boats the entire year. Below Shreveport to the mouth navigation was suspended by low stages during portions of October and November. The mouth of Red River was navigable the entire year.

List of steamboats engaged in the trade during the fiscal year 1898.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft. Light.	Draft. Loaded.	Between—	Round trips.	Passengers.
			Feet.	Feet.	Feet.	Ft. In.	Ft. In.			
Imperial	Stern wheel.	494.69	210	40.6	6.6	3 0	8 0	New Orleans and Shreveport.	3	140
Sunrise	...do...	473.31	200	45	6.5	2 0	7 6	New Orleans and— Shreveport	9	194
								Cabin Point	1	......
Electra	...do...	372.88	190	40	5.2	2 7	7 0	New Orleans and— Shreveport	7	154
								Coushatta	1	
								Ninock	1	
								Alexandria	1	
Hallette	...do...	196.8	161	30.5	4.5	2 0	6 0	Shreveport and— New Orleans	1	53
								Coushatta	5	22
								Garland	21	26
City of Little Rock	...do...	326.51	145	29	4.6	......	......	New Orleans and— Shreveport	5	56
								Lotus Landing	1	......
								Shreveport and Briarfield.	1	5
Rosa Bland	...do...	64.01	113.2	22.8	4.4	1 6	4 0	Shreveport and— Coushatta	4	1
								Garland	25	37
Valley Queen	...do...	410.83	190.6	35.8	5.6	3 0	8 0	New Orleans and— Shreveport	15	408
								Lake End	1	......
W. T. Scovell	...do...	244.8	160	31	3.7	2 0	5 6	New Orleans and— Shreveport	20	182
								Cane River	2	......
								Barbin Landing	2	......
Jo. Walker *a*	...do...	59.48	80.4	20	3	1 6	2 9	Shreveport and Whitehall.	40	......
G. W. Mayo *a*	...do...	124.06	109	20	2.5	1 3	3 0	Fulton and Long Prairie.	25	147
H. W. Graves *a*	...do...	31.22	94.6	17.6	3	1 8	3 0	Campti and Boyce	52	......
Elk	...do...	111.22	153	22	4	2 0	4 0	Shreveport, Coushatta, and above Shreveport.	22	65
Des Arc *a*	...do...	40.88	95	18	3	1 6	3 0	Coushatta and Colfax.	44	......
Waukesha	...do...	77	105	24.4	3	1 0	2 6	Shreveport and Fulton.	1	......
May Fisher *a*	...do...	52.84	92	18.8	4	2 0	2 0	Baton Rouge and Coushatta.	1	......

a With one or more barges.

List of steamboats engaged in the trade during the fiscal year 1898—Continued.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
City of Brunswick *a*	Stern wheel.	77.01	87.9	19.6	3.9	2 0	3 0	New Orleans and Shreveport.	2	......
Oceola *b*	...do...	24.39	70.6	15.2	2.9	1 2	3 0	Alexandria and Colfax. Alexandria and Jonesville.	10 1	....
Mima *b*	...do...	62.72	66	17	3.2	1 6	1 6	Vicksburg and points on Red River.	1	......
George L. Bass *b*	...do...	53.82	91	21	3.3	1 6	3 6	Alexandria and Shreveport; local towing.	....	......
Linda *b*	...do...	45	......	......	.....	1 1	3 6	Shreveport, Elmer, and Missionary.	33	......
Nellie L. *b*	...do...	......	......	......	.....	1 10	3 6	Local trips from Shreveport.	....	......
G. W. Bolton	...do...	......	80	12	4.5	......	......	Alexandria and Pineville ferry.	....	54,000
Plucky Boy	...do...	80.88	80.5	16.3	3	......	......	Alexandria and Franklin.	....	......
Bessie Siler	Tug...	49.38	93	16	3	2 0	2 6	Alexandria and Barbin Landing.	5	125
Irene *b*	...do...	27.07	77.5	18	2.8	......	......	Local towing, lower Red River.	....	......
Lee Otis	...do...	4.50	40	9	5	4 6	4 6	Alexandria and Barbin Landing. Alexandria and Boeuf River.	10 1	....
Shawnee	Yacht	21.49	50	10	3	......	......	Vicksburg and points on Red River.	....	......
Lizzie Schenck	...do...	......	......	......	.....	......	......	Alexandria and New Orleans.	1	......

a Towboats. *b* With one or more barges.

The following steamboat wrecks were reported during the year, viz: *City of Little Rock*, sunk at Hurricane Bluff, La., January 5, 1898; *Irene*, sunk near Bayou Natchitoches, La., January 29, 1898; *Linda*, sunk at Douglas Place, La., February 20, 1898 (subsequently raised); and *Rosa Bland*, sunk at Douglas Place, La., March 15, 1898.

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	18,173	15,941	13,204	18,308	15,392
Cotton seed	24,084	26,962	18,537	5,322	4,402
Cotton-seed meal	4,640	9,633	4,822	4,516	9,042
Live stock	52	15	55	49	496
Hides and skins	21	80	71	50	31
Lumber	3,297	643	1,570	1,657	1,257
Saw logs	9,000	12,885	18	20,000	28,869
Staves	630	4,084	380	697	228
Miscellaneous	3,392	1,770	2,285	3,000	105,395
Total down freight	63,289	72,013	40,942	53,599	165,112
Return freight	43,525	39,851	32,560	22,122	63,518
Total	106,814	111,864	73,502	75,721	228,630
Estimated value	$4,307,000	$4,429,000	$3,833,000	$3,419,000	$6,061,000

Summary of commerce reported—Continued.

Articles.	1892–93.	1891–92.	1890–91.	1889–90.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	14,061	29,400	21,613	18,838
Cotton seed	7,902	31,832	12,249	14,140
Cotton-seed meal	4,713	....	10,000	....
Live stock	1,185	286	38	....
Hides and skins	62	151	212	35
Lumber	1,520	2,352	....	4,519
Saw logs	15,200	22,250	16,523	....
Staves	1,739	206	81	58
Miscellaneous	5,964	14,107	2,719	136
Total down freight	52,346	100,584	63,435	37,726
Return freight	17,605	19,942	30,051	28,650
Total	69,951	120,526	93,486	66,376
Estimated value	$3,422,000	$6,877,000	$9,185,000	$6,820,000

In addition to the above, from Ouachita River entering Red River at mouth of Black River, 197,674 tons, the value of which is estimated at $5,084,000.

Receipts and shipments of bales of cotton at Shreveport, La.

	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.	1892–93.	1891–92.	1890–91.	1889–90.
RECEIPTS.									
By rail	112,835	66,666	42,860	52,573	30,033	25,277	44,256	39,890	25,476
By wagon	42,437	31,768	31,474	54,968	41,014	31,612	49,644	37,725	40,026
By river	9,219	4,611	6,679	11,319	5,581	4,821	9,189	14,836	8,897
Warehouse receipts	164,491	103,045	81,013	118,860	76,628	61,710	103,089	92,451	74,399
SHIPMENTS.									
By Texas and Pacific Rwy	25,347	31,618	22,631	34,239	25,019	26,904	36,645	23,311	23,690
By Vicksburg, Shreveport and Pacific R. R	29,117	12,191	10,441	20,239	10,546	10,384	23,251	15,564	20,813
By Houston and Shreveport R. R	13,842	17,660	16,582	22,459	13,429	3,114	5,353	13,860	12,529
By St. Louis Southwestern Rwy	33,050	20,230	16,869	28,469	17,817	7,818	24,187	15,039	8,820
By Kansas City, Pittsburg and Gulf R. R	37,906	16,672	100	....	....	....	....	....	....
By river to New Orleans	12,682	8,327	14,102	10,654	9,246	14,751	10,567	19,218	8,412
Total	151,944	106,698	80,725	116,060	76,057	62,971	100,003	86,992	74,264

The large increase of cotton business at Shreveport was due partly to completion of the Kansas City, Pittsburg and Gulf Railroad from Kansas City, Mo., to the Gulf of Mexico, and partly to the fact that the cotton crop of last year along Red River was one of the largest ever known, cotton picking having been in progress at places as late as the latter part of March. River and railroad transportation was interrupted from September to December 1 by quarantine restrictions, due to prevalence of yellow fever at New Orleans and elsewhere, which also increased the business at noninfected cities.

The competing routes of transportation for the trade of Red River Valley, below Fulton, Ark., are as follows: The river is crossed by the St. Louis, Iron Mountain and Southern Railway at Fulton, Ark., by the St. Louis Southwestern Railway (Cotton Belt route) at Garland, Ark., and by the Vicksburg, Shreveport and Pacific Railroad at Shreveport, La., and a branch of the Cotton Belt system from Lewisville, Ark., 8 miles east of Garland, runs parallel to the river to Shreveport. The Texas and Pacific Railway runs nearly parallel to the river and touches at Alexandria, Boyce, Shreveport and other points on the main river, and at Jefferson, Tex., on Cypress Bayou, and connects at Texarkana, Ark., with the Cotton Belt and St. Louis, Iron Mountain and Southern. Morgan's Louisiana and Texas Railroad, a branch of the Southern Pacific, runs from Alexandria to the main line. Shreveport is the eastern terminus of the Houston and Shreveport Railroad. The Houston, Central Arkansas and Northern Railroad, a branch of the Missouri Pacific system, crosses the river about

1½ miles above Alexandria. The Kansas City, Watkins and Gulf Railway runs from Lake Charles, La., on the Southern Pacific, to Alexandria, and is building eastward to Natchez, Miss., and another line is projected to cross at Alexandria. Jefferson, Tex., at the head of navigation of Cypress Bayou, has transportation by the Missouri, Kansas and Texas Railway, in addition to the Texas and Pacific Railway mentioned above. The Texarkana and Shreveport Railroad is built from Texarkana south 34 miles to Kiblah, Ark. The Kansas City, Pittsburg and Gulf Railroad, from Kansas City, Mo., to Port Arthur, Tex., crosses the river north of Texarkana and touches at Shreveport. During the year the construction of the Shreveport and Red River Valley Railway, from Shreveport down the left bank of the river to Coushatta, La., was commenced, and the road is in operation from Shreveport to Loggy Bayou.

W 2.

IMPROVEMENT OF RED RIVER ABOVE FULTON, ARKANSAS.

The project adopted for expenditure of funds available for improvement of this part of Red River, briefly, was as follows:

> When one of the snag boats is employed near Fulton, it is proposed to continue operations above that place as far as the boat may be able to work—to mouth of Kiamichi River, if practicable—and if driven out by a falling river, to resume operations from time to time, as circumstances will permit; the plan being that, instead of ceasing snagging operations at Fulton, under the project for improving Red River from Fulton to the Atchafalaya, they shall continue above that place until the appropriation is exhausted.

The U. S. snag boat *C. W. Howell*, M. B. Lydon, master, reached Fulton March 22, and was employed in the river above that place until April 10, 1898. Operations extended up to Spanish Bluff, 10 miles below Lanesport, Ark., and about 64 miles above Fulton. Oscillations of upper Red River are so rapid that boats frequently make but one trip on a rise, and have to regulate traffic by the quantity and duration of rainfall. When the *Howell* reached Spanish Bluff the river was falling about 3 feet a day, and it was inadvisable to continue upstream, for fear of being detained indefinitely, awaiting another rise. After passing below the Texarkana and Fort Smith Railway bridge, the stretch between that structure and Fulton was worked over the second time, and the *Howell* then returned to Shreveport, La., reached that city April 11, and was laid up in Cross Bayou.

The following is a summary of the work done by the *Howell* above Fulton, March 22–April 9, 1898, viz:

Snags pulled	268
Stumps pulled	7
Logs removed from channel	294
Shore snags cut	19
Jams removed	1
Side jams removed	1
Leaning trees cut	5

Money statement.

July 1, 1897, balance unexpended	$3,940.44
June 30, 1898, amount expended during fiscal year	1,300.90
July 1, 1898, balance unexpended	2,639.54

The appropriations have been as follows:

By act of—		By act of—	
August 5, 1886	$7,000	August 18, 1894	$3,500
August 11, 1888	3,000	June 3, 1896	3,000
September 19, 1890	2,000		
July 13, 1892	3,500	Total	22,000

COMMERCIAL STATISTICS.

List of stern-wheel steamboats engaged in the trade during the fiscal year.

Name.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.
					Light.	Loaded.		
		Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*		
Kingfisher	27	74.6	16.1	2.5	1 0	2 0	Arthur City and Kiamichi River Arthur City, Boggy River, and Hunt Ferry.	25 70
G. W. Mayo	124.06	109	20	2.5	1 3	3 0	Fulton and Little River	6
Elk	111.2	153	22	4	2 0	4 0	Fulton and Little River	2

Summary of commerce reported.

Articles.	1897-98.	1896-97.
	Tons.	*Tons.*
Lumber	2,780	....
Saw logs	10,000	12,800
Staves	490	2,287
Miscellaneous	2,000	....
Total	15,270	15,087
Estimated value	$80,000	$52,000

The river, from the mouth of the Kiamichi, the upper limit of the improvement, to Fulton, is paralleled by a branch of the Texas and Pacific Railroad from Texarkana to Paris, Tex., connecting at the latter place with the St. Louis and San Francisco Railway, a branch of the Atchison, Topeka and Santa Fe system, which crosses Red River at Arthur, Tex. The Kansas City, Pittsburg and Gulf Railroad crosses the river about ten miles north of Texarkana, and has a branch from Wilton to White Cliffs, Ark., on Little River, a distance of 7 miles, and the St. Louis, Iron Mountain and Southern Railway crosses at Fulton, Ark.

W 3.

IMPROVEMENT OF CYPRESS BAYOU, TEXAS AND LOUISIANA.

The funds for continuing this work were appropriated "For dredging and removing obstructions and straightening channel between Jefferson, Tex., and Shreveport, La." A project for their expenditure was submitted by me June 24, 1896, but was not approved by the Secretary of War until June 14, 1897, and notification of approval did not reach me until June 22, 1897. The project in full was given in my last report. (Report Chief of Engineers, 1897, p. 1896.)

Upon receipt of notification of approval of project, immediate preparations were made to send the Bucyrus elevator dredge to Shreveport, so that it should reach there before the usual protracted period of low water and be ready to cross Albany Flats on the first sufficiently high stage and commence work. The dredge left Vicksburg June 25, in tow of the U. S. snag boat *John R. Meigs*, and was delivered at Shreveport July 5, 1897. Ordinarily the lowest stages of Red River are to be expected during the latter half of the calendar year, though there have been occasional floods as late as July, with high stages late into August. When the dredge reached Shreveport, July 5, the gauge at that place read 7.1 feet, which was the highest stage until January 19, 1898, and for 108 consecutive days, September 7–December 23, the stages were below zero of the gauge. Under these conditions it was useless to try to get the dredge into Soda Lake, and it was laid up and properly cared for at Shreveport.

After completion of dredging operations in Red River at Alexandria, La., in September, 1897, it was the intention to transfer Overseer Robert Elflein to this work to organize a party and remove the worst stumps, etc., in the channel during the period of lowest water, preparatory to using the dredge when the stage should be sufficient to cross Albany Flats; but the prevalence of yellow fever at various localities in Mississippi and Louisiana, and consequent difficulties of procuring and moving labor and of shipping supplies, rendered it advisable to defer such work.

In January, 1898, after a rise of Red River set in and there was reasonable probability of getting the dredge from Shreveport into the lake, preparations were made to begin work. The U. S. snag boat *Columbia* was transferred from the work at Alexandria, La., to Shreveport to furnish quarters for employees, tow the dredge from point to point as required, and to do light snagging along the route from Shreveport to Jefferson. The trip of the *Columbia* from Alexandria to Shreveport was made January 20–28, 1898, the master, pilot, and engineer of the U. S. snag boat *O. G. Wagner* having been transferred for the temporary service, and a barge having been towed from Alexandria for use in raising and lowering the dredge conveyer.

Overseer Robert Elflein, who repaired the Bucyrus elevator dredge and is familiar with its operation, was transferred from the fleet at Alexandria, La., and put in local charge of the dredge and snag boat at Shreveport in January, to make such repairs and alterations as were necessary, and to be ready to begin work at the first opportunity. February 24–26 he made a preliminary examination of the water route from Shreveport, La., to Jefferson, Tex., by skiff, and reported as follows:

UNITED STATES DREDGE NO. 2,
Shreveport, La., February 28, 1898.

MAJOR: In compliance with your instructions to make an examination of Cypress bayou and lakes, I have the honor to submit the following report:

On my return from Vicksburg I hired a crew of three laborers, took skiff, provisions, etc., from fleet, and left Shreveport at 10 a. m. on the 24th instant. Twelve Mile Bayou was found in very good shape, with but few leaning trees, and if any stumps they could not be seen. Up to Albany there were but four channel snags in sight, and these to one side. There was no water at the "Gate Posts." The skiff had to be poled from there to Georges Landing, about 1½ miles. It is my opinion that a dredged cut across the first sharp point in the bayou below the "Gate Posts" or Albany cut road would benefit navigation. The length would be about 100 yards and depth about 8 feet. Good water was found from Big Willow Pass to Jefferson, and a small steamer could navigate between those points at the present time; in fact, I believe if I had the dredge at Mooringsport I could get her to Jefferson. I was told the lakes and bayou were swollen by recent rains, and a 2-foot fall was noticeable on the banks of the bayou. In Ferry Lake I would recommend following the bayou channel, making a dredged cut across bends, wherever it can be done, to shorten the distance, and taking out such stumps as may be in the way; but this work can be done only at extreme low water. The Bois d'Arc cut should be extended several hundred yards farther downstream to connect with the bayou channel. I believe this was the original intention, but high water or lack of funds stopped the work. The old cut has filled up considerably, and should be dredged at places to give uniform depth. From the upper end of Bois d'Arc to Benton no work is necessary, except taking out a few channel snags, and there is a deep, wide stream with plenty of water at all times. The two dredged cuts above Benton may have to be scraped over to deepen a little. There is good river from there to reach below Sisco Lake cut, where there is a kind of lump held together by roots. The stumps have been cut and blasted from this before, and it shows only at extreme low water. The channel across Sisco Lake should be scraped over and the cut stumps dredged out. These stumps have been cut down and blasted several times, but the bottom has washed out between them and they stick up again. The long Burney cut needs scraping over to deepen where it has filled in; also the Boone and Potato bends cuts. A number of sharp points between Boone Bend and Jefferson should be eased by dredging, several shoal bars removed above the sawmill, and a cut made in front of Jefferson from the landing to above the powder magazine.

I respectfully submit the following plan of operations: To tow the dredge to Jefferson, Tex., begin dredging at the landing and work downstream. Stumps in the channel to be blasted and dredged out. Blasting alone will not remove them. The numerous sunken sawlogs in the upper bayou to be taken out also. In a number of places where dredging is to be done the banks will have to be cleared of timber to allow the dredge conveyor swinging room. For this work I propose to hire, from time to time, laborers by the day, keeping them employed only so long as their services are needed. I can not see where a separate chopping party could be worked to advantage. All the chopping needed can be done by laborers employed on the dredge.

While the dredge is at work within 3 miles of Jefferson, care will have to be taken not to let her get caught by a low stage, and should the bayou fall very rapidly, it will be well to leave that part until another rise.

I recommend cutting off a portion of the ballast tank of the dredge. It is larger than is necessary, and 2 feet narrower would be an advantage upon the small bayou. I may have to take it off altogether to get through the Mooringsport bridge and some of the narrow cuts in the bayou. The conveyor ladder will have to be put in such a shape that it can be raised nearly perpendicular to clear the bank timber when moving from place to place. As it now is, it would have to be taken down and put up again whenever necessary to move, and the belt would soon wear out at the splice from cutting the rivets so often. I will send a drawing and requisition for what is needed.

If the dredge were at Jefferson now, good work could be done, as the bayou is at just the right stage for dredging.

While in Jefferon I met Mr. W. T. Atkins and others interested in the improvement of Cypress Bayou. While their desire for locks and dams is still uppermost, they wish for the present to get navigation between Jefferson and Mooringsport to connect with the K. C., P. & G. R. R. They built a small hull for this purpose, but after completion it did not pass Government inspection. It had the desired effect, however, for they got a small reduction in freight rates.

Very respectfully, your obedient servant,

ROBERT ELFLEIN, *Overseer.*

Maj. J. H. WILLARD,
Corps of Engineers, U. S. A.

The improvement of Red River above Shreveport, which has caused the bottom to scour and lower as much as 15 feet in the old raft region, and the extension of the levee system, especially on the right bank, where all but one of the outlets or so-called canals have been closed, have reduced the water supply of Cypress Bayou and the lakes to natural drainage of their basin, except when Red River overflows its banks above or rises very high at Shreveport. Albany Flats are practically bare at extreme low water, and the fall to Shreveport is about 30 feet, so that it requires a high stage of Red River in conjunction with a rise of the bayou to get the dredge across the flats and into Sodo Lake.

The Weather Bureau office at Shreveport receives the gauge readings at Fulton, Ark., and Arthur City, Tex., on Upper Red River, by telegraph daily, except Sundays, and a close watch of the bulletins was kept by the local overseer at Shreveport, so as to be prepared for the first rise. April 3 he made a trip to the "Gate Posts," just above Albany Flats, where a steamboat gauge is located (Shreveport gauge reading 12.5 feet, rising), but found the stage of Sodo Lake a foot lower than when he passed up February 24 (at which time the Shreveport gauge read 7.5 feet). The color of the water showed some inflow from Upper Red River, but it was not sufficient to raise the surface of the lake. The highest stage of Red River on the gauge at Shreveport during the fiscal year was 15 feet on May 21, 1898. The local overseer revisited Albany Flats May 14 (Shreveport gauge reading 13 feet), and again May 18 (Shreveport gauge reading 14.5 feet), but found no perceptible difference in the stage from that observed on his trip of April 3.

The following table is of interest in connection with this matter:

High-water readings of gauge on Red River at Shreveport, La.

Fiscal year.	Date.	Highest gauge reading. Feet.	Authority.
1872–1873	June 8, 9, 1873	25.5	United States Signal Service gauge records.
1873–1874	Apr. 29–May 1, 1874	27.9	Do.
1874–1875	Apr. 22, 1875	25.8	Do.
1875–1876	Apr. 11, 12, 1876	31.5	Do.
1876–1877	July 28, 1876 May 11, 12, 1877	31.9 29.8	Do.
1877–1878	Jan. 31, 1878	28.4	Do.
1878–1879	May 16, 17, 1879	24.9	Do.
1879–1880	Apr. 4, 1880	23.2	Do.
1880–1881	Mar. 7, 1881	27.3	Do.
1881–1882	Feb. 21, 1882	31.4	Do.
1882–1883	Mar. 11, 12, 1883	25.3	Do.
1883–1884	Feb. 27, 1884 May 14, 1884	32.6 32.7	Do.
1884–1885	May 11, 12, 1885	30.5	Do.
1885–1886	Apr. 29, 1886	18.3	Do.
1886–1887	Mar. 19, 1887	18.4	Do.
1887–1888	Dec. 24, 25, 1887 May 19, 1888	21.6 30.3	Do.
1888–1889	Feb. 3, 1889	31.9	Do.
1889–1890	May 8, 1890	34.7	United States engineer gauge records.
1890–1891	Feb. 12, 13, 1891	25.2	Do.
1891–1892	May 28, 1892	35.7	Do.
1892–1893	Jan. 1, 2, 1893	29.1	Do.
1893–1894	Apr. 2, 1894	34.5	Do.
1894–1895	June 30, 1895	12.1	Do.
1895–1896	July 29, 30, 1895	30.3	Do.
1896–1897	Apr. 11, 13, 1897	24.1	Do.
1897–1898	May 21, 1898	15.0	Do.

It will be seen from the foregoing that in the fiscal year 1897–1898 Red River reached the least height at Shreveport in the twenty-six years of record, with exception of the fiscal year 1894–1895, which, however, was followed by a flood stage in July, 1895, and continued high water until the middle of August. With this exception, the past fiscal year is the only period in twenty-six years that twelve months have elapsed without a stage sufficient to enable the dredge to cross Albany Flats. While the stages of 1886–1887 and 1887–1888 were not as high as ordinarily, the conditions at that time were different, as the outlets of Upper Red River had not been closed, and by reference to my reports for those years it will be seen that a steamboat drawing 4 feet navigated Cypress Bayou and the lakes.

The table also shows that, while the highest stages may be expected at any time from January to July, inclusive, they occurred most frequently in the months of April and May, or fourteen times in twenty-six years, and that the relation by months is as follows: January twice, February three times, March three times, April seven times, May seven times, June twice, and July twice.

Since January the following repairs of the plant to be used upon this work have been made at Shreveport, La.: Upon the elevator dredge a new spud was framed and prepared, boiler tubes were scraped, the ballast tank was cut back 20 inches; four wrought-iron hinges, weighing

245 pounds, were made and fitted in the conveyor ladder, so that it could be raised without loss of time when the dredge should be moving from place to place in the narrow channel of the bayou; the exhaust pipe of swinging and conveyor engines was changed to exhaust into the smokestack, to create sufficient draft at times when compelled to use wood as fuel, and the exposed ironwork showing signs of rust was repainted from time to time. To relieve a continual strain on the forward end of the dredge, an old sectional dock, which had been used for repairing bottom of the snag boat *Howell*, was calked and placed under the bucket ladder, which was then lowered upon deck, lightening the draft about 10 inches. Upon the snag boat *Columbia* new arms, braces, and buckets were made and put into the wheel; new gaskets were fitted in caps and joints of engines and pumps; boiler flues were cleaned and the furnace repaired; a capstan was set up, fitted in place, and steam connections with boiler made; the supply pipe of donkey pump was changed to discharge into boiler through the heater; cabin bulkheads were scrubbed and the roof painted, and the boiler casing, breeching, and drums were repainted. The boats were kept securely moored and pumped out, and such minor repairs as were needed from time to time for proper care and preservation of the plant were attended to promptly.

If there should be no high stage during July, the gauge records of the past twenty-six years show that none may be expected before next January. In such event it is proposed to organize a party, under supervision of Overseer Elflein, to work over the route between Jefferson and Shreveport during the period of lowest water, blowing up and destroying stumps and logs in the channel, felling leaning trees, etc.

Money statement.

July 1, 1897, balance unexpended	$14,567.75
June 30, 1898, amount expended during fiscal year	3,525.57
July 1, 1898, balance unexpended	11,042.18
July 1, 1898, outstanding liabilites	19.11
July 1, 1898, balance available	11,023.07

The appropriations for Cypress Bayou and the lakes have been as follows:

By act of—	
June 10, 1872	$10,000.00
March 3, 1873	50,000.00
August 14, 1876	13,000.00
June 18, 1878	15,000.00
March 3, 1879	6,000.00
August 5, 1886	18,000.00
August 11, 1888 (allotted from appropriation for Red River)	5,000.00
September 19, 1890, for survey	10,000.00
July 13, 1892, for survey	2,000.00
July 13, 1892 (allotted from appropriation for Red River)	1,701.33
August 18, 1894	10,000.00
June 3, 1896	5,000.00
Total	145,701.33

COMMERCIAL STATISTICS.

There was no navigation between Shreveport and Jefferson during the year.

W 4.

IMPROVEMENT OF OUACHITA AND BLACK RIVERS, ARKANSAS AND LOUISIANA.

Operations in these rivers during the fiscal year ending June 30, 1898, were continued as follows:

GENERAL IMPROVEMENT.

The U. S. snag boat *O. G. Wagner*, Watkins Decker, master, was moved from Monroe to Columbia, La., July 6–8, 1897, to get below the numerous bars in that stretch before the season of lowest water. After overhauling and repairing machinery, operations for removal of obstructions to navigation were resumed. August 2–5 work was carried up to Rutland Bar, where the boat turned back on account of the low stage. August 6–30 it continued down to Trinity, removing obstructions in the channel, cutting and destroying shore snags, stumps, and trees along the banks, and repairing the dam at Catahoula Shoals. The work required was not so heavy as in former years, as there was little current in Lower Ouachita last high stage to cut away banks and bring obstructions into the channel. The dam at Catahoula Shoals was repaired and strengthened at the place where the breach occurred in November, 1896. The section was enlarged with earth and protected on the crown and upper face by a layer of riprap, stone for the purpose having been obtained near by. The current is causing a fill above and below the dam, constantly strengthening the structure.

August 31 the *Wagner* ran to mouth of Black River, and was employed between the mouth and Trinity until September 22. All channel snags that could be located were removed, and the following landings were cleared of obstructions at request of the steamboat interest, viz: Palmetto, Emerson, Beards, Calhoun, Hardscramble, Lost Bend, Flowery Mound, Magnolia, Oakland, Enterprise, George Cross, Newhope, Rabbs, Prosperity, Monterey, Workinger Bayou, Egypt, Willow Grove, Wilson, Lismore, Norma, Normandy, Gaynor, Moss Grove, Emily, Lower and Upper Eutaw.

September 23–October 18 the *Wagner* was laid up at Tensas Point, the crew having been transferred for temporary service in Tensas River. October 19–31 Black River from Trinity to its mouth was worked over again, the stage having been 2½ to 3 feet lower than when the previous work was done in September, and the gauge at Jonesville reading below 1 foot the entire period. But 2 feet depth was found on Nicholia and Kincaid bars, and lines had to be laid to pull across. Between Monterey and Magnolia landings the boat was employed for a week removing obstructions from the bottom of the river. In this short stretch of about 3 miles 142 snags and 13 stumps were destroyed. Some of the snags were very long and reached across the channel. This has been considered the worst obstructed place in Black River at low stages, but was worked over so thoroughly that it should cause no further danger to navigation. Below Magnolia dangerous stumps were removed from the channel above Lost Bend Landing, and snags at Hardscramble, bend below Beards, McDonald, Gillespie, and Wild Cow landings. November 1 the *Wagner* was transferred to work in Red River.

The following is a summary of the work done by the *Wagner* between Rutland Bar and Red River August 2–October 31, 1897, viz:

Snags pulled and destroyed	595
Stumps pulled, cut, and destroyed	522
Logs destroyed	4
Shore snags cut	243
Leaning trees cut and destroyed	17
Repaired dam at Catahoula Shoals.	

A party equipped with axes, saws, tackle, explosives, etc., was organized by Overseer J. R. Vaughan the early part of July, 1897, for work during low stages of the upper river. Operations commenced July 14 at Champagnolle, Ark., at which place the quarter boat had been left by the survey party, by whom it had been used the preceding month. By taking advantage of a slight rise July 19–24 the quarter boat was cordeled upstream above the shoals to Camden, Ark. From the latter date to December 21 work was carried down to Monroe, La., 167¼ miles. For 105 miles, to Lapile Landing, Ark., the river was much obstructed by tree slides, caving banks, leaning timber, etc., and by logs, snags, fallen trees, and stumps in the channel, the obstructions in the channel having caused frequent formation of bars by deposits of sand and gravel against and over them. The stretch below Lapile to Lonewa, La., about 46 miles, had been worked over the latter part of 1896, and but few new obstructions had been brought in since.

Operations consisted of cutting or destroying leaning, sliding, and caving trees, logs, and stumps along the banks, and removing channel and shore snags, tree slides, logs, stumps, etc., in the river. Wherever practicable obstructions were chopped or sawed up, but when this was difficult they were hauled out with blocks and tackle or destroyed with explosives. Bars were cleared of obstructions, and snags and logs embedded in the bottom were blown up and removed thoroughly. Where the banks were caving the heavy growth of timber was felled and removed for some distance back from the river. The stages were near extreme low water the greater portion of the time, greatly facilitating work in the channel.

November 11, when near the mouth of Bayou Bartholomew, the party was transferred for temporary service in that stream until December 6, 1897, when it returned to the Ouachita.

The following is a summary of the work done by this party in Ouachita River July 14–December 21, 1897, viz:

Channel snags cut and destroyed	12,730
Shore snags cut and destroyed	1,963
Logs cut and destroyed	4,216
Stumps cut and destroyed	2,005
Leaning trees cut and destroyed	5,194
Trees girdled	786
Square yards willows and brush cut	31,993
Wreck removed, viz, Steamer *Caddo*, below Miller Bluff, Arkansas.	
Brush wing dams built	3

SURVEY.

Field work on the Upper Ouachita was suspended at Champagnolle, Ark., July 1, 1897, and the survey party was disbanded, with exception of employees required for office work, who returned to Vicksburg July 2.

July 6–24 precise levels were run by Asst. Engineer W. H. Polk between Bonita, La., on Houston, Central Arkansas and Northern Division of the Missouri Pacific Railway, to Lindgrove, on Bayou Bartholomew, thence down the bayou to its mouth, and there connected with the line along Ouachita River at precise reference point, "Parkeville." The line was carried down the left bank of the bayou, following the roads and cutting off some of the larger bends, to the lower end of Alexandria Place, where it crossed to the right bank and followed roads which gave the shortest distance to the mouth without cutting off too much of the stream at a time. Three temporary gauges were set up on Bayou Bartholomew between Lindgrove and the mouth. On completion of this work the precise level party returned to Bonita, from which point a line to Greenville, Miss., was run July 28–September 17. This line followed the Houston, Central Arkansas and Northern Railroad from Bonita, La., to McGehee, Ark., where an approximate connection was made with United States Coast and Geodetic Survey precise bench mark "G" (a copper bolt leaded into face of a chimney which had been wantonly destroyed). From McGehee levels were continued to Trippe Junction, and thence along the Warren branch to the Mississippi River at Arkansas City, Ark., where connections were made with the Coast and Geodetic Survey, Mississippi River Commission, and United States Engineer benches. A side line was run westward over the Warren branch from Dermott to Baxter, Ark., on Bayou Bartholomew, where a gauge was established and high and low-water elevations obtained. Precise benches were established at all regular passenger stations, at several flag stations, and one near the Arkansas and Louisiana line. Temporary gauges were set at Parkdale and Morrell, Ark.

September 4–6 a river crossing was made just below Arkansas City, Mississippi River Commission precise bench mark 84 and stone line bench $\frac{63}{2}$ having been tied in, and the line was continued down the levee on east bank of Mississippi River, closing on Coast and Geodetic Survey precise bench mark 1, at Greenville, Miss.

In September, 1897, Surveyor William R. Neely was sent to Monroe, La., to measure low-water discharge with instructions to continue by rail to Choudrant, La., and make a reconnoissance of the road to Bayou D'Arbonne with a view to connecting the Red River survey precise bench at Choudrant with a bench set near Cox Ferry during the survey of bayous D'Arbonne and Corney in 1883 for the purpose of recovering points of that survey and combining the information with the survey of Ouachita River. The reconnoissance was made, but the outbreak of yellow fever near Vicksburg and ensuing quarantine restrictions upon travel, etc., prevented any leveling until cold weather.

December 7 a precise level party under Surveyor Neely was sent into the field. As the preliminary examination had disclosed the fact that the hilly country between Choudrant and the D'Arbonne would make leveling difficult, that route was abandoned and levels were run from Farmerville to Cox Ferry, on Bayou D'Arbonne, tying in a bench of the 1883 survey and one high-water mark, and establishing a permanent bench; then from Farmerville to Scott and Stein bluffs, on the Corney, where permanent bench marks were set and an additional high-water mark connected with; and then easterly to Ouachita River, where they terminated on a bench of Ouachita River survey, near Port Union, La. This work was completed January 6, and the party returned to Vicksburg and was disbanded the following day.

December 10, 1897–February 3, 1898, precise levels were run by a party under Asst. Engineer W. H. Polk from a bench of the Red River survey, at Rayville, La., at the junction of the Vicksburg, Shreveport and Pacific Railroad and the New Orleans and Northwestern Railway, southward along the line of railway to Concordia, La., at the junction of the New Orleans and Northwestern Railway and the Natchez, Red

River and Texas Railroad, connecting near Concordia with the line of precise level run in 1893 from Vidalia, La., on Mississippi River opposite Natchez, to Jonesville, on Black River. This line is between Bœuf River on the west and Bayou Maçon and Tensas River on the east, crossing the latter at Clayton, La., about 7½ miles from Concordia.

Work at the office during the year was pushed as rapidly as possible, the following being a review of what was done:

Field computations in note books of every class were checked. Latitudes and departures were computed for traverse line, and checked by comparison with field computation. Azimuths of permanent reference lines were reduced, each to the meridian passing through the permanent reference point marking one end of its line. Other azimuths were corrected for each meridional convergence of one minute.

Precise levels on the Ouachita and side lines on bayous D'Arbonne and Bartholomew, and from Rayville to Concordia, were reduced and the results tabulated. Ordinary levels were reduced and the results adjusted to agreement with precise levels at points common to both. Topographical levels were reduced and adjusted to agreement with ordinary levels at points common to both.

Hydrography notes were reduced by referring bottom to datum plane of survey and cross-river distances to channel sounding. From Camden to mouth of Black River cross sections have been completed from top bank to top bank by compiling the topographical elevations taken in the prolongation of sounding ranges. Observed water surfaces have been reduced to low water of 1896 by means of stage changes indicated by the gauges, temporary and permanent. Discharge and sediment observations have been reduced. All available data respecting permanent gauges on the Ouachita, both those now in use and those discontinued, have been compiled and results tabulated.

Levels of the surveys of Ouachita River of 1871 and 1873 have been reviewed and an adjustment made for discrepancies found at benches common to both, or at benches of either touched on by the survey of 1895–1897. Observed water surfaces of 1871 and 1873 were adjusted in the light of the above general adjustment reduced to low water of 1871 and 1873, respectively, and referred to datum of the survey of 1895–1897. River distances by surveys of 1871 and 1873 have been adjusted to agreement with corresponding distances of the late survey. Channel soundings and observed water surfaces of 1871 and 1873, with their adjusted river distances, were tabulated as a basis for profiles of river for those years. Notes of Bayou D'Arbonne survey (1883) have been reviewed, and levels adjusted for the discrepancy disclosed by precise level connections with initial bench of that survey at Monroe, La., and with a bench at Cox Ferry, near upper limit of survey. Channel bottom was referred to Cairo datum, observed water surfaces reduced to low water of 1883, and the reduced elevations referred to Cairo datum and results tabulated as basis for a profile.

A general subjective index of all data determined by the survey of 1895–1897 was made, and is a résumé of results, so that any data required for publication can be easily compiled.

Field sheets of the 1895–1897 surveys, Camden, Ark., to mouth of Black River, Louisiana, were plotted in pencil during progress of field work and have been verified, omissions supplied, inked, and lettered. These maps are executed on tracing linen, scale of 1:10,000. The sheets are 23.6 inches by 31.5 inches, and are 56 in number. Twenty-four sheets have all topographical signs filled in; 8 show the leading topographical features, and the remainder are in outline. An index map, scale 1:200,000, is to be made. A profile showing right and left top banks, channel bottom, low water of 1896 and high water of 1882, Camden to mouth of Black River, as determined by surveys of 1895–1897, has been plotted to scales of 1:100,000 horizontal and 1:100 vertical, in 8 sheets of the size above noted. Originals have been traced and 10 sets of blue-print copies taken.

Profiles showing channel bottom and low-water lines, Camden, Ark., to Jonesville, La., as determined by surveys of 1871 and 1873, have been plotted to same scales as above, and traced on 7 sheets of the usual size. A profile showing channel bottom and low-water line of bayous D'Arbonne and Corney, from mouth of former to a point 4 miles above mouth of latter, as determined by Major Miller's survey of 1883, has been plotted to scales uniform with the preceding, in one sheet.

Cross sections of the Ouachita from Camden to mouth of Black River, as determined by surveys of 1895–97, have been plotted to scales of 1:2,000 horizontal, 1:200 vertical, on 70 sheets, each 19.7 inches by 31.5 inches.

Distances.	Miles.
Head of survey, 3¾ miles above Camden, to Red River	354
Camden, Ark., to Jonesville, La., at head of Black River	294
Mouth of D'Arbonne to upper limit of Major Miller's levels, 1883 (limits of profile)	44

Attention is invited to the appended report of Assistant Engineer T. C. Thomas, who has had local charge of this survey, which contains a recapitulation of the work done, methods employed, etc.

As stated in former reports, a rapid survey of Ouachita River from Trinity, La., to Camden, Ark., was made in 1871, onwhich estimates were submitted for stone and composite locks. The project was approved and timber for two locks delivered under contract; but, after review of the survey notes by a board, a resurvey was ordered. Captain (now Lieutenant-Colonel) Benyaurd was placed in charge of the district including Ouachita River in 1873, and a new survey was made under his direction. Parties were organized in May, 1873, reorganized twice, after much difficulty and delay, and the survey began at Camden June 22 and ended at Trinity December 17, 1873. Captain Benyaurd submitted alternative estimates for locks and dams, but, after having given close personal study of details, advised against a project for slack water at that time. I have gone over all of the notes of 1871 and 1873 myself, and, since benches of both surveys have been found and connected with our precise level system, I am constrained to the opinion that the levels of 1871 were better than those which followed in 1873. On the other hand, the topography and hydrography of 1873 were superior to 1871, and fit in very well with our work.

The present survey is much broader in scope than its predecessors, having in view the extension of slack water in the tributaries and not in Ouachita River alone, thus creating a system, if the project be feasible, for the main river. For this reason I had precise levels run from benches on Ouachita River to the bench of 1883 on Bayou D'Arbonne, by which the Y levels of that year may be used. For similar reasons precise levels were run between Lindgrove and mouth of Bayou Bartholomew, and from Rayville down between Boeuf River and Bayou Maçon and Tensas River. From such maps as we have been able to get I hope to make rapid surveys of all those tributaries, to determine the lengths that may be pooled in them according to pool heights at the junctions with Ouachita River. I have reconnaissance maps of Bayou Bartholomew and Boeuf River, and map of the survey of Bayou

D'Arbonne made in 1883, on scale 1:10,000, and am planning to put Tensas River and Bayou Maçon, and probably Saline River, Arkansas, on the same scale from the large maps of the General Land Office (scale 1:31,680). With these in hand small parties can make rapid progress with compass and Y level.

It is very important to run out side channels in the low lands, to avoid the risk of flanking or opening of new channels, and to determine where each dam should be put to prevent such mishap. As a large part of the low country is wilderness, progress will be difficult and slow.

When first called upon to report, with a view to improving Ouachita River by locks and dams, I thought, from the information then at hand, that it might be possible to give slack water from Trinity to Camden by means of five movable dams, but the results of the present survey are not favorable to such a project. I have plotted the longitudinal profile of the river from above Camden to Red River on vertical scale 1:100 and horizontal scale 1:500,000, showing bottom, high water, low water, and right and left banks, on a single sheet of convenient size, and I find that two points are indicated where dams must be placed, whether the system should permit few or require many dams, viz, (1) at Catahoula Shoals, above Trinity and below mouth of Boeuf River, and (2) at the Rock Row, below mouth of Bayou Bartholomew. At both points there is a very decided fall of the low-water line, and above Rock Row there is a territory known as "The Overflow," where the banks on both sides for a distance of some 40 kilometers (say 25 miles) are so low as to be overflowed at mid stages, and it is probable that a dam that should create a pool through this reach no higher than mid stage would be the pretext for damage suits far in excess of the value of the lands. On the other hand, if a high dam at Rock Row is feasible and desirable, these same lands should be bought and used as reservoirs. In either case it will be necessary to make a careful topographical survey of "The Overflow" region.

I wish to make so complete a survey that there shall be no doubt about the final conclusions, whatever they may be, and to leave so many permanent reference points and the notes in such shape that another survey shall not be needed.

During the coming season the reconnaissances will be made and the additional information sought, should nothing occur to prevent. There is some uneasiness felt lest yellow fever, which paralyzed work last year, may break out again, and therefore it is proposed to start the parties as soon as practicable. Field work will be facilitated by the lines of precise levels, especially those lately run.

A report on present information would not be satisfactory to anyone. If adverse, the people who had hoped for slack-water navigation would have just cause to complain of insufficient information, and if favorable the United States might become involved in enormous expenditures, perhaps only to end in a disgraceful failure. I think, however, that it is feasible to make a slack-water system by means of movable dams, probably not exceeding eight in number, between Trinity and Camden, 570 kilometers (354 miles), that shall give a navigable depth of not less than 2 meters, say 6½ feet, to Camden, and not less than 1 meter, say 3 feet +, for 30 to 40 kilometers, say 20 to 25 miles, in each tributary, without raising the general flood line or endangering the country more than with the present open river. The success on Big Sandy River, and the development of other forms of movable dam besides the Chanoine system, are my chief reasons for this opinion.

ESTIMATES.

Completing survey	$70,000
Quarter boats for chopping parties	5,000
Outfit, tools, and repairs	2,500
Expenses of snag boats	25,000
Expenses of chopping parties	10,000
Expenses of dredges	5,000
Administration, transportation, gauges, etc	2,500
Total	120,000

Money statement.

July 1, 1897, balance unexpended	$46,812.95
June 30, 1898, amount expended during fiscal year	26,064.63
July 1, 1898, balance unexpended	20,748.32
July 1, 1898, outstanding liabilities	61.19
July 1, 1898, balance available	20,687.13
Amount that can be profitably expended in fiscal year ending June 30, 1900	120,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The amounts expended during the year and balances July 1, 1898, are as follows:

Allotments.	Expended during year.	Balances July 1, 1898.
For general improvement, care of plant, etc	$10,185.52	$973.79
For survey	15,879.11	19,774.53
Total	26,064.63	20,748.32

The appropriations have been as follows:

Date of act.	Locality.	Amount.
Mar. 3, 1871	Between Arkadelphia, Ark., and Louisiana State line	$25,000
Do	Between Arkansas State line and Trinity, La	26,000
June 10, 1872	Between Arkadelphia, Ark., and Louisiana State line	60,000
Do	Between Arkansas State line and Trinity, La	40,000
Mar. 3, 1873	do	60,000
Aug. 14, 1876	Between Camden, Ark., and Trinity, La	12,000
June 18, 1878	do	10,000
Mar. 3, 1879	do	10,000
June 14, 1880	do	8,000
Mar. 3, 1881	do	12,000
Aug. 2, 1882	do	12,000
July 5, 1884	Between Camden, Ark., and mouth of Black River, Louisiana	15,000
Aug. 5, 1886	do	17,500
Aug. 11, 1888	do	20,000
Sept. 19, 1890	do	15,000
July 13, 1892	do	40,000
Aug. 18, 1894	Between Camden, Ark., and mouth of Black River, Louisiana, including survey	50,000
June 3, 1896	Between Camden, Ark., and mouth of Black River, Louisiana, and for completion of survey	70,000
	Total	502,500

COMMERCIAL STATISTICS.

During the fiscal year 1898 Black and Ouachita rivers were navigable for regular New Orleans boats to Camden, Ark., during the greater part of the period December 22–June 30. To Monroe, La., there was navigation for small boats the entire year. Steamboat men say it was the best boating season ever known.

List of steamboats engaged in the trade during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
						Light.		Loaded.				
			Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Ouachita	Stern-wheel.	457.45	189	38	6.5	4	0	9	6	New Orleans and Monroe.	16	2,187
City of Camden	...do...	299.23	175	35	5	2	2	5	6	New Orleans and—		1,020
										Camden	13	
										Monroe	4	
										Harrisonburg	7	
										Knights Landing	3	
										Rusts Landing	1	
										Sinope	1	
										Island Bayou	1	
										Danville	1	
										Logtown	1	
										Newport	1	
John Howard	...do...	447.52	184.6	37.8	6.3	3	0	7	6	New Orleans and—		450
										Camden	5	
										Monroe	10	
Chickasaw	...do...	733.9	186	39	5.9	3	0	7	0	New Orleans and—		500
										Monroe	14	
										Harrisonburg	1	
Parlor City	...do...	136.3	125	26	3.7	2	0	6	0	New Orleans and—		
										Monroe	11	200
										Columbia	1	......
										Harrisonburg	2	......
										Bres Landing	1	......
										Bœuf River	1	......
										Monroe and Bayou D'Arbonne.	1	......
Victor *a*	...do...	138.67	138.5	26	4.6	......		......		New Orleans and Monroe.	4	......
										Monroe and Bayou D'Arbonne.	12	......
Sterling White	Side-wheel.	117.09	120	30.5	4.2	2	0	4	6	Monroe and—		
										Champagnolle	1	......
										Alabama Landing	2	......
										Ouachita City	6	......
										Harrisonburg	1	......
										Bayou Bartholomew.	24	91
C. A. Hill *a*	Stern-wheel.	69.62	119.5	21.3	3.6	......		......		New Orleans and Camden.	1	......
Ramos *a*	...do...	37.61	60.2	11.5	6.0	......		......		New Orleans and Monroe.	1	......
Rosa B *b*	...do...	41.85	82.6	15.8	3	1	5	2	6	Monroe and—		25
										Bayou D'Arbonne	21	
										Bayou Bartholomew.	3	
										Bœuf River	1	
										Kelly Bayou	1	
										Lonewa	1	
Oceola	...do...	24.39	70.6	15.2	2.9	1	0	2	6	Jonesville and—		
										Little River	52	......
										Tensas River	21	......
Belle Prince *a*	...do...	109.12	114.4	19.6	3.6	1	0	7	6	New Orleans and Saline River.	2	......
R. J. Wheeler *a*	...do...	140.17	126	26.2	3.9	2	6	......		New Orleans and Moro Bay.	3	......
Lillie *a*	...do...	61.42	120	26	3.5	2	0	3	6	Jonesville and New Orleans.	1	......
										Also local towing between Little River and mouth of Red River.	....	......
Daisy *a*	...do...	106.64	122	22	3.8	2	6	3	6	New Orleans and Monroe.	1	......
T. K. Green *b*	...do...	32.77	81.8	17.3	3.1	1	8	3	0	Knight Landing and Bœuf River.	18	......
Belle of D'Arbonne	...do...	74.59	111	22	3.7	2	0	4	0	New Orleans and Camden.	1	......
										Monroe and Camden	4	......
										Monroe and Bayou Bartholomew.	29	......
Bettie Lee *b*	...do...	28.56	56	12	2.5		10	2	6	Jonesville and Bayou Maçon.	41	......
Thomas A. Hendricks *a*.	...do...	81.86	108	22.5	4.2	4	2	5	0	New Orleans and Saline River.	1	......

a Towboat. *b* With one or more barges.

List of steamboats engaged in the trade during the fiscal year—Continued.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
Shiloh *a*	Stern-wheel.	14.00	64	14	2.6	......	......	Monroe and Bayou D'Arbonne.	104	......
John B. Robinson *a*	...do	12.00	65	12	2.5	1 0	2 6	Monroe and Bayou D'Arbonne.	104	......
May Fisher *b*	...do	52.84	92	18.8	4	2 0	2 0	Baton Rouge and Bayou Maçon.	5	......
C. B. Bryan *a*	...do	330.44	114.2	29	4.5	2 0	4 2	Trinity and Little River. Vicksburg and Jonesville. Trinity and Tensas River.	30 1 35	250 200
G. W. Lyon *b*	...do	124.67	115	22	4.4	......	......	New Orleans and Camden.	1	......
Teal *a*	...do	48.28	85	19.6	4	......	......	No report.		
Stoneware *b*	...do	104.45	100	17	3	2 2	3 6	New Orleans and— Tensas River Bœuf River	1 2	....
Will Davis *b*	...do	150	100.8	23.6	3.6	1 8	2 2	New Orleans and Upper Ouachita.	1	......
Josephine Loviza *b*	...do	93.25	113.6	22.2	3.7	2 4	3 6	New Orleans and Tensas River.	1	......
J. W. Swayze *a*	...do	86.62	110	21	3.7	1 8	3 6	Jonesville and Little and Tensas rivers.	50	......
City of Brunswick	...do	77.01	87.9	19.6	3.9	2 0	3 0	New Orleans and Bœuf River.	1	......
Julia H *a*	Tug	4.9	35	7	.....	3 6	3 6	Jonesville and Bœuf River. Stafford and Bœuf River.	3 40	....
Dixie *b*	...do	16.94	52.6	12	4	4 0	4 6	New Orleans and Monroe.	3	......
Lee Otis	...do	4.5	40	9	5	4 6	4 6	Alexandria to Stafford. Stafford and Bœuf River.	1 100	....
Dora *a*	Launch	3.5	38	9	5	2 11	4 0	Jonesville and Tooley.	313	117
Wayzata	...do	6	33	7	3.7	1 9	2 2	Local towing at Monroe.	....	......
Skipper	...do	......	......	......	.....	......	......	.....do	....	......
Irwin	...do	3	35	8	.....	2 6	3 2	Stafford and Bœuf River.	104	......

a With one or more barges. *b* Towboat.

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	19,813	12,959	9,599	21,070	11,176
Cotton seed	15,734	22,657	4,706	6,005	3,645
Hides and skins	44	16	68	166	72
Live stock	574	561	254	329	549
Lumber	1,063	2,302	1,080	218	262
Saw logs	31,244	51,066	49,000	10,000	28,257
Staves	97,614	119,059	26,332	18,891	31,519
Miscellaneous	8,445	3,540	7,112	5,660	6,572
Total down freight	174,531	212,160	98,151	62,339	82,052
Return freight	23,143	17,390	19,866	11,340	13,808
Total	197,674	229,550	118,017	73,679	95,860
Estimated value	$5,084,000	$5,722,000	$5,123,000	$3,293,000	$3,430,000

Summary of commerce reported—Continued.

Articles.	1892–93.	1891–92.	1890–91.	1889–90.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	11,383	21,890	21,433	16,652
Cotton seed	4,423	5,577	6,593	5,058
Hides and skins	4	7	25	36
Live stock	845	89	172	62
Lumber	18,000	461	16,388	7,951
Saw logs	28,000	26,880	120,000	50,000
Staves	9,378	23,402	17,888	21,159
Rock	....	....	18,000	....
Miscellaneous	5,251	5,197	10,856	783
Total down freight	77,284	83,503	211,355	101,701
Return freight	11,157	18,317	27,842	40,766
Total	88,441	101,820	239,197	142,467
Estimated value	$4,466,000	$6,680,600	$9,130,000	$10,234,250

Of the above freights for 1897–98, the tributaries of Ouachita River contributed 46,984 tons, valued at $1,076,000.

Receipts and shipments of bales of cotton at Monroe, La.

Route.	1897–98.		1896–97.		1895–96.		1894–95.	
	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.	Received.	Shipped.
Vicksburg, Shreveport and Pacific R. R.	17,273	25,473	11,406	19,661	17,418	27,077	16,514	31,389
Missouri Pacific Rwy	29,918	37,259	21,421	28,381	14,731	19,975	22,383	32,271
River	7,148	9,278	1,579	3,133	3,770	6,267	4,698	5,204
Wagon	17,478	....	17,087	....	17,872	....	25,358	....
Total	71,817	72,010	51,493	51,175	53,791	53,319	68,953	68,864

The compress at Monroe cost $80,000, has a storage capacity of 12,000 bales, and a compressing capacity of 100 bales an hour.

Receipts and shipments of bales of cotton at Camden, Ark.

Route.	1897–98.		1896–97.	
	Received.	Shipped.	Received.	Shipped.
Missouri Pacific Railway	4,382	9,860	1,342	5,381
St. Louis Southwestern Railway	2,180	8,796	3,896	6,902
River	517	7,868	918	5,963
Wagon	21,197	....	13,822	....
Total	28,276	26,524	19,978	18,246

The following information was furnished by the Camden Commercial League as showing the resources of the country whose commerce and freight rates are affected by navigation of Ouachita River:

	1897–98.	1896–97.	1895–96.
Population of territory affected	634,332	608,983	564,518
Annual cotton crop (estimated) ... bales	893,438	878,578	813,498
Estimated value	$35,737,520	$34,150,230	$32,539,920
Present freight rate per bale to eastern seaboard	$3.50	$3.50	$3.50
Freight saving on cotton, if water route were available	$1,665,650	$1,640,000	$1,550,000
Annual crop of cotton seed (estimated) ... tons	430,000	420,000	385,000
Estimated value	$4,100,000	$4,000,000	$4,000,000
Freight saving on cotton seed, if water route were available	$1,250,000	$1,235,000	$1,145,000
Lumber marketed ... tons	6,348,915	5,228,318	4,835,000
Value of lumber shipped	$101,600,000	$91,896,080	$82,700,000
Taxable property in district	$91,618,000	$87,538,000	$84,635,000
Amount of freight paid all lines of transportation	$23,985,000	$18,785,000	$17,815,000
Amount of business transacted	$236,875,000	$212,958,000	$197,895,000

The prevailing freight rates are as follows: By river from New Orleans to Camden, on flour, meats, rice, sugar, molasses, salt, nails, bagging, ties, etc., per 100 pounds, ranges from 10 cents for salt to 12½ cents for flour, and not to exceed 25 cents on other articles. By rail the rate is 70 cents per 100 pounds for all. A bale of cotton goods weighing 400 pounds costs $1.10 for transportation by river and $4.40 by rail. The freight on a carload of cheap furniture from Chattanooga, Tenn., to Camden, Ark., amounted to $133. From Chattanooga to Memphis, Tenn., 310 miles, the charge was $22, but from Memphis to Camden, 208 miles, it was $111. When there is navigation the rate per bale on cotton from Camden to New Orleans is $1 by rail or boat, but when navigation is suspended it is advanced to $3.10 by rail.

The competing lines of transportation are as follows: Ouachita River is crossed by the St. Louis, Iron Mountain and Southern Railway at Arkadelphia, Ark.; by the St. Louis Southwestern Railway (Cotton Belt Route) at Camden, Ark., and by the Vicksburg, Shreveport and Pacific Railroad at Monroe, La. The St. Louis, Iron Mountain and Southern Railway has a branch line parallel to the river from Eldorado to Gurdon, Ark., and thence by the main line to Arkadelphia. A projected extension of this branch will give direct communication with the Mississippi River at Arkansas City, Ark., the part to be built being from Camden to Warren, Ark., a distance of about 50 miles. The Houston, Central Arkansas and Northern Railroad (another branch of the Missouri Pacific system) connects with Arkansas City at McGehee, 12 miles west, and thence runs in a southwesterly direction about midway between Bayou Bartholomew and Bœuf River, touches the Ouachita River, and crosses the Vicksburg, Shreveport and Pacific Railroad at Monroe, La., and continues down, parallel to the main river, to Columbia, La., crossing at Riverton, 4 miles above Columbia, and runs thence to Alexandria, La. The Natchez, Red River and Texas Railroad (narrow gauge) runs from Black River Station, opposite Trinity, to Vidalia, La., on Mississippi River opposite Natchez, Miss. The New Orleans and Northwestern Railway is completed from Natchez, Miss., to Bastrop, La., and crosses Tensas River near its mouth and Bœuf River about 2 miles north of Rayville, La. The extension of the Kansas City, Watkins and Gulf Railway from Alexandria, La., to Natchez, Miss., has been begun, and will cross Black River about 7 miles below Trinity, La. The Mississippi River, Hamburg and Western Railway, a lumber road, has been constructed from Sunnyside on Mississippi River to Hamburg, Ark., crossing Bayou Bartholomew near Portland, and probably will be extended westward.

REPORT OF MR. T. C. THOMAS, ASSISTANT ENGINEER.

U. S. ENGINEER OFFICE,
Vicksburg, Miss., May 19, 1898.

MAJOR: I have the honor to submit report on the survey of Ouachita and Black rivers, Arkansas and Louisiana, made under your direction.

Beginning November 20, 1893, precise levels were run from bench marks of the Coast and Geodetic survey at Vidalia, La. (1880), to Jonesville, La., and thence up the Ouachita to Bayou Dan. Party then went to Monroe, La., and, starting from benches of the Red River survey (1889), ran down the Ouachita, closing at Bayou Dan April 16, 1894, having run, in all, 180 kilometers main line and 10 kilometers side line in eighty-eight days of actual leveling. September 25 to November 24, 1894, precise levels were run from Jonesville, La., down Black River to its mouth, closing on an ordinary level bench of the Red River survey (1891), 54 kilometers main line and 3 kilometers side line, run in thirty-five days of actual leveling. October 18 to December 31, 1894, a second party ran precise levels from benches of the Coast and Geodetic survey at Little Rock, Ark. (1887–88), to Frenchport, Ark., touching on the Ouachita at Arkadelphia, Ark., Camden, Ark., and terminal of line; 209 kilometers of main line and 5 kilometers side line run in sixty days of actual leveling.

March 15–28, 1895, Maj. J. H. Willard, accompanied by two assistants, made a reconnaissance of the Ouachita from Camden to Jonesville on the U. S. snag boat *Wagner*. The river as found was compared with maps of the 1873 survey, and search was made for benches of the surveys of 1871 and 1873. Inquiry was made for high-water marks, and such as were found, together with all old bench marks recovered, were referred by checked ordinary levels to permanent monuments set for the purpose or to precise level benches already established where available. Permanent gauges were tested and a new gauge established at Champagnolle, Ark.

September 12 to December 28, 1895, a general topographical survey was carried from Champagnolle to Sinope Landing, La., a river distance of 266 kilometers, covered in eighty-seven days of actual field work. Precise levels were run in conjunction with the general survey from Eldorado Landing, Ark., to Monroe, La., closing on bench of Red River survey (1889); 133 kilometers main line and 5 kilometers side line run in sixty days of actual leveling. September 21 to December 28, 1896, general survey was carried from Sinope Landing to mouth of Black River, La.; 224 kilometers covered in eighty days of actual field work. May 7–31, 1897, lines were cut preliminary to a general survey from Camden to Champagnolle. In conjunction precise levels were run from Frenchport, terminal of precise level line from Little Rock, to Champagnolle, resting on precise bench of Ouachita River survey (1895), 34 kilometers main line and 4 kilometers side line, in fourteen days of actual leveling. June 3 to July 1, 1897, general survey was carried from a point 6 kilometers above Camden to Champagnolle, a river distance of 80 kilometers; days of actual field work, twenty-four.

Beginning July 5, 1897, at Bonita, La., precise levels were run to Lind Grove Landing, on Bayou Bartholomew, thence down bayou to mouth, resting on a bench of the Ouachita River survey (1895). Returning to Bonita, levels were run via McGehee and Arkansas City, Ark., to Greenville, Miss., reaching last-named point September 17, 1897. Total run, 196 kilometers main line and 13 kilometers side line, made in sixty days of actual leveling. This line touches on several benches of the Coast and Geodetic survey and of the Mississippi River Commission. The benches intermediate Bonita and McGehee are within a reasonable distance of Bayou Bartholomew, and side line was run to bench established on bayou at Baxter, Ark.

December 10, 1897, to February 3, 1898, precise levels were run from a bench of the Red River survey (1889) at Rayville, La., to a bench of the Ouachita River survey (1893–94) at Concordia, La.; 110 kilometers main line and 6 kilometers side line run in thirty-two days of actual leveling. December 8, 1897, to January 6, 1898, a second party ran precise levels from Stein Bluff, La., on Bayou Corney, via Farmerville, La., to Ouachita River near Port Union, La., resting on a bench of the Ouachita River survey (1895); 42 kilometers main line and 4 kilometers side line run in nineteen days of actual leveling.

The total main river distance covered by general survey is 570 kilometers, with 44 kilometers on navigable tributaries, made in 191 days of actual field work. The total of precise levels is 954 kilometers main and 50 kilometers side line, made in 368 days of actual leveling for one party.

The complete survey embraces the following features: A traverse line, precise levels, ordinary levels, topography, hydrography, temporary and permanent gauges, discharge measurements, and sediment observations.

The organization of special parties was as follows:

Traverse line.—Assistant, pioneering for route; observer, reading angles; 1 foreman and 2 to 6 axmen (according to country), opening lines; and 2 tapemen.

Precise levels.—Observer, recorder, 2 rodmen, and 1 umbrella man.

Ordinary levels.—Observer, rodman, and axman.

Topography.—Observer, recorder, and 4 rodmen.

Hydrography.—Recorder, in charge; leadsman and 2 skiffmen.

Following is the average cost per kilometer of the principal features of the field work:

Class of work.	Average cost per kilometer.	Distance, how reckoned.
Traverse line	$11.50	Along traverse line.
	7.18	Along river channel.
Precise levels	8.73	Along precise level line.
Ordinary levels	4.00	Along river channel.
Topography	12.11	Do.
Hydrography	4.07	Do.
Gauges	1.28	Do.
Total (excepting precise levels)	28.64	

There is considered in above, cost of labor, subsistence, and material expended, excepting stationery. Travel expenses to or from points of beginning or suspending operations and cost of permanent outfit not included. The average cost of subsistence for the general survey was 27 cents per ration served. The precise level parties, when working independently, were generally quartered with people living along the route. The average cost of subsistence and quarters under such circumstances was 74 cents per man per diem.

The general survey carried one special party for each of the first four features enumerated above, except for stretch from Monroe to mouth of Black, where two topography parties were employed, and for stretches where precise levels had been run previous to general survey the corresponding special party was omitted. Discharge and sediment work was done by the sounding party or by a party similarly organized. A draftsman accompanied the general survey for plotting topography notes as taken, and during field seasons of 1895 and 1897 an extra topographer was carried for sketching hill lines, etc.

TRAVERSE LINE.

The greater part of country covered by survey being densely wooded, a triangulation would have been unduly expensive. A traverse line was therefore selected as the basis for horizontal coordinates. This line follows, in the general case, the most direct route consistent with giving frequent check points for the stadia work. Where traverse cut was followed by the precise levels—Frenchport, Ark., to mouth of Bartholomew—river crossings were avoided when this could be done without an unreasonable increase in length of line. From Monroe to vicinity of Riverton, La., 43 kilometers, traverse follows the Houston, Central Arkansas and Northern division of the Missouri Pacific Railway.

At intervals of about 8 kilometers by river there were established *permanent reference lines*, consisting each of a *permanent reference point* and a *permanent azimuth point* set on a known azimuth. Permanent reference points are located and leveled to, and are intended to perpetuate both horizontal and vertical coordinates. Two types of monuments are employed for these points, viz:

(*a*) *Pipestone.*—Limestone block 46 centimeters square and 15 centimeters thick, with copper bolt leaded in upper face and buried to depth of 1.2 meters, access being given through 12-centimeter iron pipe centered over bolt. Pipe has cast-iron cap secured by a transverse bolt with head and nut. The cap has a small boss and the letters U. S. E. o B. M. raised on top. Horizontal coordinates refer to vertical through boss of cap and underground bolt. Elevations taken both on boss and bolt, but the difference of elevation between the two points can be taken at 1.24 meters without material error in any case. This type was adopted from the Mississippi River Commission surveys.

(*b*) *Pipe flange.*—Section of 4-centimeter gas pipe about 160 centimeters long, capped at upper end and sometimes flattened to an edge at lower end, and having a 12-centimeter circular flange attached near lower end by lock nuts. Monument set with top projecting about 1 decimeter above ground surface. Flange surrounded in the usual case by a matrix of neat cement, approximately doubling the bearing area of flange. Horizontal coordinates and elevations refer to center of outside cap. This type designed by Maj. J. H. Willard.

Permanent azimuth points are located, but not leveled to. They are intended primarily, in conjunction with the associated *permanent reference points*, to perpetuate azimuths. These points marked by sections of 4-centimeter gas pipe 160 centimeters long, capped at upper end and flattened to an edge at lower end. Monument set, partly by excavation and partly by driving, with top 1 decimeter above ground surface.

Angles of the traverse were read with 20-second transit, using method of repetition in sets, thus: (1) Telescope direct; azimuth to preceding station set up on limb; starting with preceding station, turning upper motion positive or negative and reading azimuth of forward station (and of side points if any); three repetitions of angle between preceding and following station. (2) Telescope inverted; circle shifted; starting with following station and turning upper motion negative or positive; three repetitions. Horizon closed at all stations except for stretch from Champagnolle to Bayou Lapile, Arkansas, 45 kilometers by traverse. The limiting error for horizon closure was 30 seconds; for closure of triangles at river crossings, 20 seconds.

Signals were $1\frac{1}{4}$-inch octagonal range poles, painted red and white in alternate sections, or 1 by 1 inch pine pieces covered with red and white cloth where necessary to a clear definition, centered over stations and left in place. Where a short stretch was unavoidable, readings were taken on tally pins wrapped in red cloth or on colored plumb lines, a background of white cloth, on frame, being provided in either case.

Initial and check azimuths were determined by observations on circumpolar stars at and near *elongation*, the usual programme for angles being followed, except that sets were taken without repetition, and as many sets observed as was practicable without introducing any considerable correction for reduction to elongation. For the reduction of azimuth observations and computation of meridional convergences, approximate latitudes were determined from meridian altitudes of circumpolar stars, observed with a 1-minute vertical circle.

The several checks between azimuths as directly observed and as carried by *traverse* from each observed azimuth to the next, and corrected for convergence, are given below.

TABLE 1.—*Comparison of observed and carried azimuths.*

Locality.	Azimuth.						Discrepancy.		Number of intermediate stations.
	Observed.			Carried.					
	°	′	″	°	′	″	′	″	
Camden, Ark	163	28	53	....			....		....
Walnut Hill, Ark	110	57	54	110	58	31	0	37	33
Champagnolle, Ark	295	43	50	295	45	32	1	42	40
Pigeon Hill, Ark	253	52	12	253	51	32	0	40	34
Belle Point, Ark	217	01	06	217	02	53	1	47	33
Shiloh Shoals, Ark	221	05	04	221	04	15	0	49	32
Alabama Landing, La	100	30	01	100	30	21	0	20	11
Bayou Lonewa, La	93	34	33	93	35	22	0	49	31
Terry Place, La	111	01	29	111	02	58	1	29	22
Columbia, La	193	09	21	193	10	52	1	31	21
Yong Landing, La	247	18	36	247	20	28	1	52	27
Bayou Bushley, La	23	17	15	23	16	40	0	35	29
Jonesville, La	166	52	39	166	53	23	0	44	15
Alton Landing, La	152	40	00	152	39	34	0	26	17
Mouth of Black River, La	321	05	30	321	06	08	0	38	32

Distances along traverse were measured, in duplicate, with steel tape, the limiting error being at first 1 in 3,000. This limit was shortly cut to 1 in 5,000, the results having shown that the latter degree of accuracy could be easily attained. Tapes used were standardized in field November 12, 1895, by comparison with the 100 (±) meter steel tape of Vicksburg United States Engineer Office, using base apparatus designed by Asst. Engineer H. M. Marshall, and described in Chief of Engineers' Report, 1893, pp. 1926–1935.

An azimuth *latitude* and *departure* computation was kept up in field, and whenever *easting* or *westing* indicated a meridional convergence of 1 minute, azimuths were corrected accordingly. Asst. Engineer H. M. Marshall introduced this method on the survey of Red River, season of 1891–92. Azimuths, *latitudes* and *departures*, were recomputed in office and checked by comparison with field reduction. Azimuths of permanent reference lines have been reduced, each to meridian of permanent reference point of corresponding line, and adjusted for discrepancy between observed and carried azimuths.

HYPSOMETRY.

(*a*) *Precise levels.*—The general physical characteristics of routes followed by the several lines of precise levels are as follows:

Little Rock to mouth of Black: Line follows St. Louis, Iron Mountain and Southern Railway from initial point to Gurdon, Ark., then a branch of that road, to Elliott, Ark., 200.3 kilometers over railroad bed. Country is hilly and road has heavy grades, especially near Little Rock. From Elliott to Frenchport, 8.4 kilometers, levels follow country road across a series of high ridges. Soil a sandy clay, generally frozen during time levels were run. From Frenchport to Bayou Bartholomew, 129 kilometers, levels follow the cut made for traverse line, running through a flat bottom country, densely wooded. The ground is, in the general case, a shallow alluvium underlaid with firm clay. Many swamps were crossed, generally dry at time of leveling. From Bayou Bartholomew to mouth of Black, 228.6 kilometers, levels follow dirt roads, traversing a flat valley country having a sandy alluvium deeper than for stretch above. Country is well cleared, except for stretch from Sandy Bayou south to head of Black River, 57.2 kilometers, which is mostly wooded.

Mouth of Bartholomew to Greenville: Levels followed dirt roads from initial point to Bonita, 59.4 kilometers, traversing flat bottom lands of the Bartholomew; soil sandy loam; country well cleared. From Bonita to McGeehee line follows Houston, Central Arkansas and Northern Railroad, thence along another branch of the Iron Mountain Railway to Arkansas City, 102.1 kilometers over railroad bed. Crossing the Mississippi at last-named point, line continues along top of levee to Greenville, 34.9 kilometers; levels run in the open over a buckshot soil.

Port Union to Stein Bluff: Levels follow dirt road; country very hilly; soil a sandy clay, varying to almost pure sand in some localities; three-fourths of route in woods.

Rayville to Concordia: Levels follow roadbed of New Orleans and Northwestern Railway; country flat.

Vidalia to Jonesville: Levels follow roadbed of Natchez, Red River and Texas Railroad; country flat.

Permanent bench marks were established along the several lines of levels at intervals of about 8 kilometers. Along Ouachita and Black rivers these benches generally coincide with the permanent reference points of *traverse line.* On the line from Port Union to Stein Bluff and from Rayville to Concordia monuments were set some time before levels were run. A considerable number of the monuments on the Ouachita were also set some time previous to the level connections.

Precise levels were run with Kern instruments and rods; curvature of the bubble tubes used varied from 2.9 seconds to 4 seconds per division. The rods were compared with each other September 21, 1892, at Vicksburg United States Engineer Office, by determining a common difference of elevation with each rod in rotation; level mounted on brick wall, and length of sight the least that would give a good definition. One of the rods (No. 3) was standardized by the Coast and Geodetic Survey in June, 1894.

The method of observing is that described in Chief of Engineers' Report, 1877, page 1189, and Professional Papers, No. 24, page 598, with modifications introduced by Assistants L. L. Wheeler and J. B. Johnson. (See Chief of Engineers' Report, 1884, pages 2457 and 2547.)

In 1894 on line from Little Rock to Frenchport a further modification was introduced, which consisted in reading backsights both before and after reading foresight at each instrument setting, the mean of the two backsights being adopted as an approximation to a theoretical backsight taken at same instant as the actual foresight. This modification used in all levels run subsequent to 1894, except stretches from Frenchport to Champagnolle and Stein Bluff to Port Union. The general method attempts to eliminate instrumental errors, curvature, and refraction by keeping *fore* and *back sight* distances closely balanced at all points of a run. If at close of run these distances are found not balanced, the difference of elevation found for terminal benches is corrected for the instrumental errors, corrections being computed as functions of the difference between sum of foresight distances and sum of backsight distances for the run. Each stretch leveled in duplicate, original and check line being run in opposite directions, and by the same observer. The limiting discrepancy between forward and back runs was 5 millimeters $\times \sqrt{\text{length of stretch in kilometers}}$.

The precise levels run by present survey, together with levels, precise and ordinary, run by other surveys, close six loops, as follows:

TABLE 2.—*Loop closures.*

Loop.	Terminals of stretches.	Terminal bench marks.	Length of stretches.	Difference of elevation.	Error of closure.	Leveled by—
			Kilometers.	*Meters.*	*Millimeters.*	
I	Mouth Black River	◬ 439	....	....	....	
	Barbin Landing	*a* T. B. M. 51	29	*a*+ 2.861	....	R. R. S. (1891–92).
	Monroe	P. B. M. 27	468	+ 6.413	....	R. R. S. (1889–91).
	Mouth Black River	◬ 439	193	− 9.336	−62	O. R. S. (1893–94).
II	.....do	◬ 439	....	....	....	
	Jonesville	P. B. M. 4	54	+ 2.018	....	O. R. S. (1894).
	Vidalia	P. B. M. LXII	42	+ 2.200	....	O. R. S. (1893–94).
	Black Hawk Landing	P. B. M. LIII	70	− 2.702	....	C. & G. S. (1880).
	Grand Cut off Bayou	S. L. P. $\frac{44}{4}$	3	*a*+ 1.446	....	M. R. C. (1882).
	Mouth Black River	◬ 439	24	*a*− 2.897	−65	R. R. S. (1891–92).
III	Concordia	T. B. M. 9	....	....	....	
	Jonesville	P. B. M. 4	29	− 3.142	....	O. R. S. (1893–94).
	Monroe	P. B. M. 27	139	+ 7.318	....	O. R. S. (1893–94).
	Rayville	P. B. M. 16	36	+ 0.696	....	R. R. S. (1889).
	Concordia	T. B. M. 9	110	− 4.916	−44	O. R. S. (1897–98).
IV	.....do	T. B. M. 9	....	....	....	
	Rayville	P. B. M. 16	110	+ 4.916	....	O. R. S. (1897–98).
	Delta	P. B. M. 215	80	+ 3.421	....	R. R. S. (1889).
	Vidalia	P. B. M. LXII	141	− 8.587	....	C. & G. S. (1880–81).
	Concordia	T. B. M. 9	13	+ 0.276	+26	O. R. S. (1893–94).
V	Monroe	P. B. M. 27	....	....	....	
	Mouth Bayou Bartholomew.	Parkeville. P. R. P.	35	− 0.234	....	O. R. S. (1895).
	Greenville	P. B. M. 1	196	+16.404	....	O. R. S. (1897).
	Delta	P. B. M. 215	189	−12.005	....	C. & G. S. (1880).
	Monroe	P. B. M. 27	116	− 4.118	+47	R. R. S. (1889).
VI	Mouth Bayou Bartholomew.	P. R. P. Parkeville.	....	....	....	
	Little Rock	P. B. M. I or 3	338	+56.807	....	O. R. S. (1894–95).
	Wilkerson Landing	P. B. M. 84	183	−38.012	....	C. & G. S. (1887–88).
	Greenville	P. B. M. 1	32	− 2.312	....	M. R. C. (1880–81).
	Mouth Bayou Bartholomew.	P. R. P. Parkeville.	196	−16.404	+79	O. R. S. (1897).

a By ordinary levels; all other differences result from precise levels.

NOTE.—Abbreviations in foregoing table have the following signification: ◬, triangulation station; T. B. M., temporary bench mark; P. B. M., permanent bench mark: S. L. P., stone line point; P. R. P., permanent reference point. Also, R. R. S., Red River Survey; O. R. S., Ouachita River Survey; C. & G. S., United States Coast and Geodetic Survey; M. R. C., Mississippi River Commission.

For the precise levels run by Coast and Geodetic Survey, errors due to nonadjustment of instrument were eliminated by observing with telescope normal and inverted, bubble direct and reversed. Each sight corrected for inequality of pivots, curvature and means horizontal refraction computed as functions of length of sight, and for temperature of brass scale on rod. From Black Hawk Landing to Billas Landing two simultaneous lines were carried by one instrument over each stretch, alternate stretches being leveled in opposite directions. Levels from Black Hawk to Vidalia, and first 61 kilometers of stretch from Vidalia to Delta are included in the above. For the remaining levels run by Coast Survey, each stretch was leveled in duplicate in opposite directions. The limiting discrepancy for all the Coast Survey levels was 5 millimeters $\sqrt{2 \times \text{length of stretch in kilometers}}$. For the precise levels run by Mississippi River Commission the method was essentially the same as for the Ouachita River Survey, with same limiting discrepancy.

The ordinary levels run by the Red River Survey, and forming part of Loops I and II, were run in a succession of local loops, the check line generally closing back on initial bench of loop by a route different from that followed by original line to terminal of loop. These levels were locally adjusted by distributing the error of closure of any local loop as a linear function of the number of instrument settings in such loop.

The ordinary levels of the Mississippi River Commission involved in Loop II were checked locally by connections with precise benches of the Coast and Geodetic Survey. Whole error of closure was referred to the ordinary levels and distributed as a linear function of the number of instrument settings.

Loops I and II, with III and IV taken as one, together with three additional loops formed by levels of the Red River and Coast and Geodetic surveys, were made the subject of a general adjustment in 1895. (See Chief of Engineers' Report, 1895, p. 1903.) No adjustment has yet been made for the loops closed later than 1895.

The elevation of P. B. M. 27 (R. R. S., 1889) at Monroe, La., resulting from a local adjustment based on levels of verification run between the several benches at Monroe in 1893–94 and from the subsequent general adjustment of 1895, is used as a basis for all elevations in the territory north of Monroe. These elevations can be referred to the locally adjusted elevation of P. B. M. 27 by adding 9 millimeters. Elevations south of Monroe along Ouachita and Black rivers, and from Vidalia to Jonesville, are those resulting from the general adjustment of 1895. Elevations on line from Rayville to Concordia are based on elevation of P. B. M. 16 at Rayville, as determined by precise levels of 1889 from Coast and Geodetic Survey P. B. M. 215 at Delta. They are therefore independent of the general adjustment of 1895.

(*b*) *Ordinary levels.*—Ordinary levels of the Ouachita River Survey were run with Buff and Berger instrument, having a 10-second bubble tube. They were checked by connections with the precise level benches, the limiting error of closure being 4 centimeters for any distance. In the final reduction of notes the whole error of closure for any stretch was referred to the ordinary levels and distributed as a linear function of number of instrument settings intermediate the check points.

Ordinary levels were run to water surface at sounding ranges, gauges, high-water marks, and such benches of former surveys as could be recovered; also to occasional stadia stations. One bench of the 1871 survey of the Ouachita River was recovered, and another probably recovered. Six benches of the 1873 survey were recovered, and two others probably recovered. A high-water mark tied in by latter survey was also probably recovered, and an indirect connection with levels of both surveys was obtained by tracing the changes made in the Camden gauge. The survey of 1873 touched on 25 benches of the earlier survey. The levels of 1871 were checked by duplicate, sometimes triplicate, runs for the first 36 kilometers of survey, original and check lines being run in same direction—upstream. For remainder of 1871 survey a single line was run, two observers leveling alternate stretches—always upstream. The levels of 1873 were run by one observer, in a single line—always downstream. Levels of both 1871 and 1873 show, in marked degree, the cumulative errors characteristic of long lines of levels run continuously in one direction. These levels have been adjusted by distributing, as linear functions of distance run, the discrepancies disclosed at points common to both of the earlier surveys, or at points of either recovered by present survey.

Levels of the survey of Bayou D'Arbonne (1883) have been tied in at Monroe, initial point of survey, and at Cox Ferry, near Farmerville. The discrepancy disclosed, being no greater than was to be expected in a single line of that length run in one direction, was distributed through the 1883 levels in the usual way.

In 1893–94 Mr. Charles W. Babbit, C. E., made a levee survey from Lum Landing to head of Black River, and thence along Tensas River and Brushy Bayou to north boundary of Concordia Parish, La. Levels of this survey have been tied in at six points on Black River, and at Frogmore and Clayton on the tributary line. Mr. Babbit has kindly furnished this office with the principal results of his survey, and high-water elevations, etc., have been adjusted in the light of check connections above mentioned by the usual method.

(c) *Topographical levels.*—The vertical circles of instruments used on topography read down to 1 minute; the telescope bubble tubes have a curvature of 49 seconds per division. When practicable, elevations were determined by reading rods with telescope bubble centered. This method adopted from the Red River Survey, where it was introduced in 1889. The country covered by survey being flat, it was seldom necessary to use vertical angles. These levels checked by closure of loops and connection with points of the higher orders of levels, the limiting discrepancy being 4 decimeters for any distance. In the final reduction the whole error of closure on precise levels or adjusted ordinary levels was referred to the topographical levels and distributed as a linear function of the number of stadia stations.

To show roughly the accuracy of these levels there have been selected the last ten closures of each topographer for each field season, fifty closures in all, with following results: Average length of stretch leveled, 4.1 kilometers; average of discrepancies, all taken with one sign, 4 centimeters; number of discrepancies between 0 and 1 decimeter, 46; 1 and 2 decimeters, 3; 2 and 3 decimeters, 1.

TOPOGRAPHY.

Topography was taken with transit and stadia, the usual instruments and methods being employed except as to levels, for which see "Hypsometry." Instruments read to 30 seconds on horizontal limb, 1 minute on vertical limb, and had fixed stadia hairs with ratio of 1:100 (±) between rod intercept and distance. Stadia rods were graduated in true metric units. Limiting discrepancies were: In azimuth, 5 minutes; in distance, 50 meters; in elevation, 4 decimeters; all for any size of loop closed.

Main banks were traced with care. All bayous, breaks, and marked depressions in main banks were investigated, and if found to constitute a side waterway leading back to river at some other point, they were in the general case traced through instrumentally, paying special attention to thalweg. In a few cases these flank waterways lay so far from river that it was impracticable to trace them. All land subject to overflow by the ordinary high waters, except the very low country above mouth of Bartholomew, was taken to a distance of 800 meters from river, or back to wood line in case of clearings. All important tributaries were run out a distance of 3 to 8 kilometers from the main stream; minor tributaries were run out 800 meters. In taking back country a stadia line was run approximately paralleling river. Contour points were taken along ridge lines of divides and thalwegs of depressions. In the absence of such salient features as the above, contour points were often taken along lines normal to the general direction of river, and passing through the stadia stations. Considerable sketching was done with prismatic compass and pedometer. Hill lines and limits of overflow lying far back from river were thus located. Land corners were tied in to furnish a check on this work.

Topography was plotted in field as taken on scale of 1:10,000. The field sheets made in pencil on tracing linen have been completed in office, inked, and lettered; 214 kilometers (river distance) of this work is in outline; 97 kilometers have the topographical signs partly filled in, and 259 kilometers show full topography. Topography of the 1873 survey has also been plotted in outline on tracing linen to same scale as the later survey.

HYDROGRAPHY.

River cross sections were taken at intervals of about 400 meters in pools and 50 meters or less on shoals. Cross sections located by stadia; individual soundings located by *steel* cable, marked at 10-meter intervals by lead bullets cast on cable. Shoal soundings made with wooden rod. Cross sections extended from water surface to top banks by contour points observed or interpolated in prolongation of sounding range. In the final reduction river bed has been referred to datum plane of survey through soundings and elevation of water surface at time of sounding, the results being thus independent of river stage.

GAUGES.

In addition to the gauges regularly maintained other permanent gauges were established, dividing river into stretches of about 40 kilometers, and these gauges read by local observers during progress of survey. Further, each of the two divisions of general survey party maintained temporary gauges set at each stopping point of quarter boats. The records of the several classes of gauges have been used in reducing observed water surfaces to low water, two general methods being employed for different reaches of river, viz:

(a) Time of stage travel from permanent gauge to permanent gauge was determined by plotting hydrographs for these gauges and noting when crest of *rises* and troughs of *falls* passed successive gauges. This time interval is different for different river stages, and was determined, in the case of any two consecutive gauges, for a stage approximately that obtaining while survey was between the gauges in question. Stage was assumed to travel at uniform rate between consecutive gauges. A temporary gauge having been set at known position intermediate two permanent gauges, and initial reading taken at once, the antecedent time when corresponding river stage passed permanent gauge above and the subsequent time when such stage reached permanent gauge below was found by simple proportion. Readings for the permanent gauges at these times were scaled from the hydrographs of these gauges, and these readings, less the minimum readings of the gauges, gave the *reduction to low water* at upper and lower gauge for the stage obtaining at time of setting the intermediate temporary gauge. The reduction to low water was assumed to vary uniformly (with distance) from its value at upper gauge to its value at lower gauge, and its value at intermediate temporary gauge computed by simple proportion. Hydrographs of temporary gauges were plotted and low-water lines determined as above laid down thereon. There being no temporary gauge standing while quarter boats were moving, the record of these gauges is not continuous. The breaks were bridged by exterpolating forward from the hydrograph of gauge discontinued and back from hydrograph of gauge next established, the mean result being adopted. Reduction to low water for any observed water surface was scaled from hydrograph of nearest temporary gauge in existence at the time. Reduction made mainly by graphical methods.

(*b*) For second method a hydrograph for time that survey was between two permanent gauges was plotted from *rise* and *fall* as shown by the temporary gauges (the record for latter gauges being made continuous, as explained above), and zero taken at low water, as shown by upper permanent gauge. Corrections to low water obtained as the sum of two interpolations. The first, or *time correction*, was scaled from above hydrograph for the time of observing a water surface. The second, or *position correction*, was obtained by distributing, in proportion to distance, the discrepancy between the temporary gauge hydrograph and the hydrograph of the lower permanent gauge, plotted with reference to low water at that gauge, comparison being made for time at which survey passed lower permanent gauge.

Observed water surfaces of 1895, 1896, and 1897 have been reduced to low water of 1896; those of 1873 to low water of that year, using second of methods described above. The survey of 1871 maintained no permanent gauges, but after passing Catahoula Shoals kept a record of rise and fall. Observed water surfaces reduced to low water of 1871 by second method, beginning hydrograph at point where survey encountered actual low water and plotting backward to Catahoula Shoals and forward to Camden. There being no data for determining *position correction*, it was omitted. Observed water surfaces of survey of D'Arbonne reduced by the second method. Both methods gave good results for slowly varying stages approximating to low water; neither were satisfactory for a rapidly rising or falling river. Fortunately the last-named conditions were the exception for the several surveys reduced.

DISCHARGE.

Discharge measurements were made during progress of general survey, observations being taken once a week in the usual case, but more frequently when any marked change of stage rendered a determination desirable. In addition, a series of observations were made at Jonesville in November, 1894, at Catahoula Shoals in December, 1894, and at Monroe March and April, and again in September, 1897. A number of observations were made by survey of 1873 in the upper river, by a special survey at Catahoula Shoals in 1890 and by the Red River survey at mouth of Black in 1891.

For observations made by present survey discharge sections were determined as noted under "Hydrography;" soundings made with rod when depth permitted; velocities determined by Price current meter at mid depth. Velocities observed at channel and at points symmetrically disposed on either side, the extreme stations being taken as near the banks as practicable. Before quitting a section registrations at the several stations were inspected, and if these indicated any marked lack of symmetry with reference to the channel velocity additional observations were taken at intermediate stations, selected according to judgment. Meter generally run at any station for two minutes, and registrations recorded at end of first and second minutes. If any material discrepancy resulted between the two-minute count and twice the one-minute count the observations were repeated, not necessarily to obtain an agreement, but to determine if current was pulsating. Observations taken from skiff held in place by steel cable stretched across stream, graduations on cable serving to locate velocity stations. In shallow water meter was suspended from boom projecting over bow of skiff; in deep water it was suspended from miniature shears overhanging stern of skiff. Meter rated at intervals by being carried forward and back over a known course, generally in running water, time and registrations being noted. Revolutions of meter wheel determined by counting clicks of an electric register in circuit with meter and three to four Leclanche cells. Many attempts were made to adjust register so as to get correct tally on dials, but it was found that this tally could never be trusted implicitly, the difficulty being, it is thought, in the varying strength of battery current. Experiments have lately been made in this office with a Bell telephone receiver in circuit with meter and a single Mesco dry cell, with satisfactory results.

Discharge observations reduced by a method original with Assistant H. M. Marshall and described in Chief of Engineer's Report, 1893, page 1976, viz: "The cross section and [transverse mid depth] velocity curve having been plotted, the product of the velocity at any point by the depth of the cross section at that point, the two being measured on the diagram, is plotted as an ordinate to the width of the cross section at the same position at which the factors obtained. If points be thus plotted wherever there is a considerable change in depth or mid-depth velocity, the curve drawn through them is a graphical representation of the discharge and the area * * * is the measure thereof."

Final results diminished by 4 per cent to allow for excess of mid depth over mean velocity. Areas of cross sections and of discharge curves taken off with a Lorber rolling planimeter. In prosecuting this work it developed that cross-section paper as furnished by the trade is seldom true, and that error is different in different directions; further, the paper varies an appreciable amount with varying hydrometric conditions. For this reason an approximate setting only could be obtained by calculation, the true setting being found by successive trials. A method of determining setting direct and by one trial was developed. The equation of any planimeter, polar or rolling, is of the form $A=\frac{xy}{c}$, in which A = area of any plotted figure selected for determining *setting;* x = distance of tracing point from center of motion of tracer arm, or *setting* required; y = result recorded by instrument; c = constant, depending on the instrument and area scale of drawing. Make $x=A$ (numerically), then by equation $A=\frac{Ay}{c}$, or $y=c$. Hence if the figure be traced out by planimeter with the setting A, the difference of the initial and final readings will be the constant c for the given instrument and *scale*. Now c is the required setting, for making $x=c$ above equation becomes $A=\frac{cy}{c}=y$. Or for setting c, instrument will give areas direct for all figures plotted to same scale as trial figure.

For the discharge observations of 1873 velocities were determined by floats. Character of float, whether *rod* or *double*, is not stated, but depth of immersion is given, and it is presumed that double floats were used. In reducing these observations observed velocities were reduced to mean in same vertical by applying coefficients scaled from a curve based on the observations of Gen. Theo. G. Ellis, given in Chief of Engineer's Report, 1875, vol. 3, p. 344.

The velocity observations of 1890 at Catahoula Shoals were made with surface floats, and observed velocities reduced to mean by applying the coefficient 0.9165. (See Chief of Engineer's Report, 1891, p. 1968.) Velocity observations of 1891 at mouth of Black made with meter at mid depth.

SEDIMENT.

Sediment samples were usually collected in conjunction with the discharge observations. A weighted bottle with valve stopper used in collecting, and samples taken from surface, mid depth, and bottom, at three or more verticals equally spaced in the cross section. The weight of water (with sediment) retained for examination as one sample was about 14,000 grains.

Ratio of weight of sediment to weight of water carrying same in suspension obtained by filtering sample and weighing residue by the usual methods.

PROFILES.

Profile showing right and left top banks, levees, high-water line of 1882, low-water line of 1896, and channel bottom from vicinity of Camden to mouth of Black (570 kilometers) has been plotted to a horizontal scale of 1:100,000 and vertical scale of 1:100 on tracing linen. Low-water lines and channel bottoms, Camden to Trinity (475 kilometers), for 1871 and 1873, as determined by surveys of those years, plotted to same scales.

River distances by the earlier surveys have been adjusted to present survey by making comparisons at well-identified localities, landings, mouths of bayous, etc., and prorating the discrepancies disclosed over the intervening stretches. A similar profile of Bayou D'Arbonne, based on survey of 1883, is in preparation.

I can not commend too highly the services of the gentlemen associated with me in this work. These were: Assistant Engineer Walter H. Polk and Surveyor William R.

Neely, precise levels and topography; Assistant Engineer G. C. Haydon, topography; John Hilleke and F. Y. Parker, drafting; Surveyor Edwin Polk, ordinary levels; Recorder B. W. Pegues, traverse line and topography; Recorder Joseph Wright, precise levels, topography, and hydrography; Recorder R. E. Tilden, topography, and Recorder Charles L. Coleman, hydrography.

Very respectfully,

T. C. THOMAS, *Assistant Engineer.*

Maj. J. H. WILLARD,
Corps of Engineers, U. S. A.

W 5.

IMPROVEMENT OF BAYOU BARTHOLOMEW, LOUISIANA AND ARKANSAS.

A party equipped with axes, saws, explosives, etc., working under the supervision of Overseer James R. Vaughan, was transferred from Upper Ouachita River November 11 and employed in Bayou Bartholomew until December 6, 1897, when it returned to the Ouachita. Operations commenced at the mouth of the bayou and were carried upstream about 38 miles, to Point Pleasant, La.

The work consisted of felling leaning trees, cutting logs, stumps, brush, channel and shore snags, burning drift, etc. Heavy logs, snags, and stumps were blown up. Tree slides were removed at the following places, viz: Goodwin Bend, below and above Desiard, Guthrie Bend, Scarborough Place, Marble Place, and Ford Place. The bayou was at an extreme low stage, favorable for work, and all obstructions below Point Pleasant were destroyed.

The following is a summary of the work done, viz:

Channel snags cut and destroyed	1,011
Shore snags cut and destroyed	342
Logs cut and destroyed	439
Stumps cut and destroyed	246
Leaning trees cut and destroyed	472
Square yards of willows and brush cut	1,094
Cords of drift burned (approximate)	450

The available funds having been exhausted by this work, nothing further could be done.

The annual cost of maintaining the work in Bayou Bartholomew was estimated to be $2,500. Drift, sliding and caving banks, and the rapid growth of vegetation constantly add new obstructions, which, if allowed to remain, accumulate more rapidly and become more difficult to remove each year.

Money statement.

July 1, 1897, balance unexpended	$1,126.47
June 30, 1898, amount expended during fiscal year	1,126.47
Amount that can be profitably expended in fiscal year ending June 30, 1900, for maintenance Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	5,000.00

The appropriations have been as follows:

By act of—		By act of—	
March 3, 1881	$8,000	July 13, 1892	$5,000
August 2, 1882	5,000	August 18, 1894	5,000
July 5, 1884	5,000	June 3, 1896	4,000
August 5, 1886	5,000		
August 11, 1888	5,000	Total	47,000
September 19, 1890	5,000		

COMMERCIAL STATISTICS.

Bayou Bartholomew was reported navigable from December 1 to June 30 in the past fiscal year.

List of steamboats engaged in navigation during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Between—	Round trips.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
Sterling White	Side wheel.	117.09	120	30.5	4.2	2 0	4 6	Monroe and various landings not stated.	24	91
Belle of D'Arbonne	Stern-wheel.	74.59	111	22	3.7	2 0	4 0	....do	29	....
Rosa B	..do	41.85	82.6	15.8	3	1 5	2 6	Monroe and Point Pleasant.	2	....
								Monroe and Lindgrove.	1	....

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.	1892–93.	1891–92.	1890–91.	1889–90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	1,206	175	1,235	1,390	2,434	1,000	2,372	3,971	2,000
Cotton seed	2,950	9,040	270	3,826	2,991	1,300	3,326	2,467	4,000
Cotton-seed meal	....	....	....	....	....	....	1,425	516	....
Saw logs	1,000	2,020	7,683	....	159	2,000	4,450	20,080	11,839
Staves	832	2,165	6,012	117	2,569	2,375	1,648	17,822	....
Miscellaneous	900	224	350	100	665	175	410	1,340	....
Total down freight	6,888	13,624	15,550	5,433	8,818	6,850	13,631	46,196	17,839
Return freight	1,188	615	2,110	1,200	3,469	825	1,534	3,103	4,000
Total	8,076	14,239	17,660	6,633	12,287	7,675	15,165	49,299	21,839
Estimated value	$284,000	$97,000	$561,000	$243,000	$564,000	$136,000	$515,000	$826,000	$492,700

This stream is crossed at Baxter, Ark., the upper limit of improvement, by a branch of the St. Louis, Iron Mountain and Southern Railroad, which connects with the Mississippi River at Arkansas City, Ark., runs west 56 miles to Warren, Ark., and probably will be extended to Camden, on the Ouachita, which is connected with the main line by a branch to Gurdon, Ark. The Houston, Central Arkansas and Northern Railroad (another branch of the Missouri Pacific system) runs parallel to Bartholomew from McGehee, Ark., to Monroe, La. The New Orleans and Northwestern Railway, completed to near Bastrop, La., crosses the Houston, Central Arkansas and Northern Railroad at Collinston, 7 miles south of Bastrop. A new line from Sunnyside Landing, Ark., on the Mississippi River, to Hamburg, Ark., crossing Bayou Bartholomew near Portland, Ark., has been built.

W 6.

IMPROVEMENT OF BŒUF RIVER, LOUISIANA.

No work for improving Bœuf River was done during the fiscal year ending June 30, 1896.

It was inadvisable to attempt the closure of any of the outlets near Point Jefferson with the limited amount available, for reasons given in my last report. (Report Chief of Engineers, 1897, p. 1917.)

For maintenance of the work done, by removal of obstructions brought into the stream since last operations were suspended, it is proposed to transfer the party and outfit from Bayou Maçon and Tensas River when work in those streams ceases.

The amount expended during the year was the proportion reserved for payment of office charges against this appropriation for the past two years.

Money statement.

July 1, 1897, balance unexpended	$8,328.46
June 30, 1898, amount expended during fiscal year	270.00
July 1, 1898, balance unexpended	8,058.46
July 1, 1898, outstanding liabilities	.86
July 1, 1898, balance available	8,057.60
Amount (estimated) required for completion of existing project	24,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900 (For closing outlets, $24,000; for maintenance, $2,500.)	26,500.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
March 3, 1881	$5,000
August 2, 1882	5,000
July 5, 1884	5,000
August 5, 1886	5,000
August 11, 1888	6,000
September 19, 1890	5,000
July 13, 1892	$10,000
August 18, 1894	8,000
June 3, 1896	6,000
Total	55,000

COMMERCIAL STATISTICS.

Bœuf River was reported navigable from December 15, 1897, to June 30, 1898.

List of steamboats engaged in navigation in the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.
						Light.		Loaded.			
			Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*		
Parlor City	Stern wheel.	136.30	125	26	3.7	2	0	6	0	New Orleans and Girard.	1
City of Brunswick	do	77.01	87.9	19.6	3.9	2	0	3	0	New Orleans and Bœuf River.	1
Stoneware	do	104.45	100	17	3	2	2	3	6	do	2
T. K. Green	do	32.77	81.8	17.3	3.1	1	8	3	0	Knight Landing and Alto	18
Rosa B.	do	41.85	82.6	15.8	3	1	5	2	6	Monroe and Mrs. Jordan's.	1
Julia H.	Tug	4.9	35	7	.....	3	6	3	6	Mouth and Gumpoint Moutn and Turkey Creek	15 25
Lee Otis	do	4.5	40	9	5	4	6	4	6	Stafford and various landings.	100
Irwin	Launch	3	35	8	.....	2	6	3	2	do	104

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.	1892–93.	1891–92.	1890–91.	1889–90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	375	130	707	876	900	626	1,583	1,760	1,397
Cotton seed	1,860	188	1,633	2,313	2,550	1,878	1,178	716	731
Hides and skins	2	1	8	1	....	....	50		
Live stock	21	....	64	76	12	....	19	....	....
Lumber	870	23	1,100	75	300	250	1,352	....	....
Saw logs	20	....	840	....	....	....	1,223	....	....
Staves	1,660	10,675	4,000	1,389	4,626	923	3,138	1,777	263
Miscellaneous	200	20	190	136	450	300	72	179	....
Total down freight	5,088	11,037	8,542	4,866	8,838	3,977	8,615	4,432	2,391
Return freight	211	224	425	250	650	335	1,370	3,458	1,594
Total	5,219	11,261	8,967	5,116	9,488	4,312	9,985	7,890	3,985
Estimated value	$130,000	$69,000	$270,000	$159,000	$350,000	$200,000	$501,000	$636,500	$580,850

The Vicksburg, Shreveport and Pacific Railroad crosses Bœuf River near Girard, La., and the New Orleans and Northwestern Railway crosses about 2 miles north of Rayville, La. The Houston, Central Arkansas and Northern Railroad runs parallel to the river on the west, and a line is projected (Louisiana, Arkansas and Missouri Railroad) which will touch the river at several points on the east.

W 7.

IMPROVEMENT OF TENSAS RIVER AND BAYOU MAÇON, LOUISIANA.

To save cost of building separate quarter boats and of organization and equipment it was intended to employ but one party for work in the several tributaries of Ouachita River, moving from one to another as funds ran out or as the stages might render advisable. Repeated requests having been made, however, for the removal of obstructions in Lower Tensas River by those interested in navigation, the work was assigned to Watkins Decker, master of the U. S. snag boat *Wagner*, that vessel being employed at the time in Lower Ouachita and Black rivers. The snag boat could not enter Tensas River on a stage low enough to permit efficient work for removal of snags, logs, etc., on the bottom, and an old quarter boat at Ouachita City, La., was floated down Ouachita River to Trinity for temporary use of the crew of the *Wagner* while engaged upon this work.

Operations were confined to Tensas River between its mouth and Kirk Ferry, about 35 miles upsteam and 5 miles below mouth of Bayou Maçon. September 24–27, 1897, the quarter boat was moved upstream to Alphenia Plantation, about 3 miles below Kirk Ferry. September 28 work commenced at the latter place and was carried down to the mouth, which was reached October 16, operations having been expedited by a second party in the lower part of the river under direction of the pilot of the *Wagner*.

The stage was low, about 6 inches above extreme low water, and all obstructions in the channel and along shore were destroyed except mud lumps and shoals. From Kirk Ferry to the railroad bridge at Clayton few obstructions were found. Below Clayton to Hunter Bar there was good depth of water, but the channel was obstructed with snags and stumps, and some dangerous stumps were destroyed along the banks, notably at Kimball Bayou Plantation. At Hunter Bar there was only 12 inches depth for a distance of 150 feet and the shoal was strewn with snags and stumps. The channel and landings at Mayhew, Maitland, and Lamarque plantations were cleared of obstructions. At the latter place there are numerous small islands and mud lumps in the river, the tops of which were out of water at the time from 1 to 2 feet, all of which were cleared of snags, stumps, etc. The channel and landings at Dunbarton and Cash Bayou plantations also were freed of snags and stumps. Below the latter place to Chamberlain Landing there was good depth, but a great many snags and stumps in the channel. The least depth on Chamberlain Bar was 15 inches, and for a distance of a mile or more it ranged between 15 and 24 inches. From Chamberlain's down there are no bars, except a mud reef one-half mile above the mouth, and the channel and banks were freed of obstructions. A landslide about 2½ miles above the mouth has contracted the channel and afforded better navigation than before it occurred. There was 20 inches depth at this place and 18 inches on the mud bar just above the mouth.

The project for this work does not contemplate navigation at low stages, and no attempt was made to remove any of the bars, which, if accomplished, would only lessen the depth in the pools above and cause the stream to drain more rapidly. Blasting mud lumps with dynamite would do little good, as the banks are soft and miry and will cause upheavals of the bottom at low stages from time to time, and any violent explosions would have a tendency to cause the upper banks to crack and slide.

The following is a summary of the work done September 28 to October 16, 1897, viz:

Channel snags pulled and destroyed	488
Stumps in channel pulled and destroyed	323
Stumps cut	635
Shore snags cut	186
Logs removed from channel	27
Logs cut up along banks	11
Trees removed from channel	4
Trees felled	21

The latter part of April, 1898, a quarter boat belonging to the United States, which had been laid up at Trinity, La., on Ouachita River, was towed to Upper Bayou Maçon preparatory to resuming work in that stream, but an overflow of Arkansas River, due to breaks in the levee on the right bank near the head waters of the Maçon and heavy local rains, kept the bayou at a stage too high to work to advantage until June 27. On that date a party equipped with tools and explosives was organized by Overseer J. R. Vaughan at Floyd, La., and by June 30 had worked downstream 5 miles to Motley Place, removing the following obstructions to navigation:

Snags cut and destroyed	190
Stumps cut and destroyed	43
Shore snags cut and destroyed	72
Logs cut and destroyed	119
Leaning trees cut and destroyed	64
Square yards of willows and brush cut	2,242

This work will continue until the available funds are exhausted.

The original project contemplated an expenditure of $40,000 for thorough work in one low-water season. Operations have dragged along for seventeen years, with small and intermittent appropriations, which permitted the removal of the worst obstructions from time to time. Drift brought down by floods, caving and sliding banks, and the rapid growth of timber and brush along the banks create new obstructions every year, which should be removed in the interest of safe navigation.

Money statement.

July 1, 1897, balance unexpended	$4,980.82
June 30, 1898, amount expended during fiscal year	2,115.78
July 1, 1898, balance unexpended	2,865.04
Amount (estimated) required for completion of existing project	4,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	4,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The appropriations have been as follows:

By act of—		By act of—	
March 3, 1881	$3,000	July 13, 1892	$5,000
July 5, 1884	4,000	August 18, 1894	5,000
August 5, 1886	4,000	June 3, 1896	5,000
August 11, 1888	5,000		
September 19, 1890	5,000	Total	36,000

COMMERCIAL STATISTICS.

In the fiscal year Tensas River was reported navigable from July 1 to 18 and from December 23 to June 30, and Bayou Maçon for about the same period.

List of steamboats reported navigating Tensas River and Bayou Maçon in the fiscal year 1898.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.
						Light.		Loaded.			
			Feet.	Feet.	Feet.	Ft.	In.	Ft.	In.		
May Fisher	Stern-wheel.	52.84	92	18.8	4	2	0	2	0	Baton Rouge and mouth of Bayou Maçon.	1
Oceola	...do...	24.39	70.6	15.2	2.9	1	0	2	6	Jonesville and various landings on Tensas River.	21
Josephine Loviza	...do...	93.25	113.6	22.2	3.7	2	4	3	6	New Orleans and Bayou Maçon.	1
Daisy	...do...	106.64	122	22	3.8	2	6	3	6	....do....	1
J. W. Swayze	...do...	86.62	110	21	3.7	1	8	3	6	Jonesville, Upper Tensas, and Warsaw on Bayou Maçon.	25
Bettie Lee	...do...	28.56	56	12	2.5		10	2	6	Jonesville and Floyd on Bayou Maçon.	41
Dixie	Tug	16.94	52.6	12	4	4	0	4	6	New Orleans and Bayou Maçon.	1
Stoneware	Stern-wheel.	104.45	100	17	3	2	2	3	6	....do....	1
C. B. Bryan	...do...	330.44	114.2	29	4.5	2	0	4	2	Trinity, Tensas River, and Bayou Maçon (200 passengers).	35
Teal	...do...	48.28	85	19.6	4	......		......		No report received	....

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.	1892–93.	1891–92.	1890–91.	1889–90
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	3, 635	1, 310	1, 038	1, 543	450	498	3, 762	2, 760	1, 527
Cotton seed	13, 048	3, 544	2, 444	2, 993	1, 400	1, 457	4, 876	4, 850	2, 920
Hides and skins		2		50	2	3		10	2
Live stock		200		290	108	3	10	6	
Staves	2, 934	10, 321	285	260	895	26	71	1, 032	3, 325
Lumber	1, 060	400	640	4, 012	300		440		
Miscellaneous	465	100	150	1, 045	104		1, 942	378	50
Saw logs	575	5, 000							
Total down freight	21, 717	20, 877	4, 557	10, 193	3, 259	1, 987	11, 101	9, 036	7, 824
Return freight	1, 022	1, 419	272	2, 092	2, 700	662	5, 886	6, 000	5, 216
Total	22, 739	22, 296	4, 829	12, 285	5, 959	2, 649	16, 987	15, 036	13, 040
Estimated value	$600, 000	$535, 000	$146, 000	$561, 000	$389, 000	$122, 500	$990, 000	$999, 500	$742, 390

The Vicksburg, Shreveport and Pacific Railroad crosses Bayou Maçon near Delhi, La. The New Orleans and Northwestern Railroad crosses Tensas River at Clayton, Concordia Parish, La.

W 8.

IMPROVEMENT OF YAZOO RIVER, MISSISSIPPI.

The U. S. snag boat *John R. Meigs*, P. R. Starr, master, which had been sent to tow a dredge to Shreveport, La., for use in Cypress Bayou and the lakes, returned to Vicksburg from Red River July 15, and after undergoing repairs, receiving supplies, etc., entered Yazoo River and commenced work July 26, 1897. Operations were carried to the head of the river and thence back to mouth of Big Sunflower River, and consisted of removing channel obstructions, shore snags, and tree slides, and clearing sliding and caving banks of trees, stumps, and brush. For the latter purpose a large force of laborers was hired after the river reached a low stage.

On account of the spread of yellow fever throughout the South, and the close proximity of the disease at Edwards Station, Miss., to this work, under authority of the Secretary of War operations were suspended and the boat returned to Vicksburg September 17. There was only 18 inches depth on the bar at the entrance into the Mississippi, but after extraordinary exertions and seven and a half hours' continuous hard work the *Meigs*, drawing 3 feet, finally ploughed her way through, though at times it would have been practicable to have walked dry-shod on the sand around the lower side of the boat. September 18 such records, etc., as were required for the transaction of official business were taken aboard, the boat proceeded to Hopefield Bend, Ark., a short distance above Memphis, Tenn., and was used as a temporary office until October 29, when it returned to Vicksburg. By order of the State board of health the *Meigs* was forbidden to land at Vicksburg, and was compelled to anchor out in the river until noon November 3, when permission to come ashore was granted.

After examination it was found that the *Meigs* would be unable to cross the bar at the mouth and resume snagging operations, and needed minor repairs of the vessel were made. By the use of a small side dock a patch 6 by 72 inches was put on the starboard side forward to cover a crack in upper knuckle lap; another patch 72 inches long was put over the same crack about 20 feet aft, and 2 rivets in butt joint under the mess room were replaced. Two cracks in the knuckle plate aft of suction pipe were calked and stopped, and 3 small bulkheads were made inside the hull and cemented. The rudders were taken off, repaired, and replaced; the port boiler tubes were calked, and the joints and connections of both boilers were overhauled and repaired. The wheel was repaired with new arms, circles, and braces where needed, and repainted; the compartments of the steel hull were scraped, cleaned, and repainted, and the breeching, boilers, chimneys, pipes, and iron connections, and boiler deck and stern bulkheads were repainted. The capstan and main engines were overhauled and repaired, and steam and water pipes were renewed where necessary, etc.

The water having risen sufficiently to enter the Yazoo, supplies were taken aboard, and the *Meigs* left Vicksburg January 4 to resume work in that river. Operations were carried upstream to the head, at the junction of Tallahatchie and Yallabusha rivers, which was reached January 13. All obstructions that could be located or caught with the drag chain were removed on the way up. A number of tree slides having been reported in the Tallahatchie, the boat continued up that river, where it was employed for five days, but returned to the Yazoo January 18. Continued rains had put the river at a stage too high for effective work, and little could be accomplished on the down trip. On January 21 the United States quarter boat which had been used in Big Sunflower River was towed by the *Meigs* from the mouth of that stream to Yazoo City, and the next day the snag boat returned to Vicksburg and was laid up with the plant in Lake Centennial.

The following is a summary of the work done by the *Meigs* in Yazoo River July 26, 1897, to September 17, 1897, and January 4 to 22, 1898, viz:

Snags pulled	262
Stumps pulled	129
Stumps cut and blown up	935
Shore snags cut	489
Logs removed from channel	195
Tree slides removed	20
Side jams removed	9
Leaning trees cut	11,101
Leaning trees topped	136
Trees girdled	16,554
Square yards brush and willows cut	4,925

Wrecks removed, viz: Portions of steamer *Mary E. Keene,* burned 1864 at French Bend; 2 boilers of steamer *Blanks Cornwall,* wrecked January 24, 1896, one-fourth mile below Dewdrop; and 1 boiler from steamer *John F. Allen,* burned October 9, 1896, at mouth of Big Sunflower River.

Towed United States quarter boat from mouth of Big Sunflower River to Yazoo City.

Under my instructions, in January, 1898, the master of the *Meigs* examined the situation of recent wrecks in Yazoo River, and reported that the steamer *Fifteen*, which sank at head of Honey Island October 30, 1897, would not be an obstruction at high stages, but would be difficult to pass at low water, and that the wreck of the sawmill steamboat *Rover*, which sank at the bank at Vanland Landing November 13, 1897, will be little in the way unless carried farther into the river. Notices were sent in January to the owners of both vessels that unless prompt measures were taken for removal of the wrecks they would be subject to be broken up and removed under section 8 of river and harbor act of 1890, without further notification.

The master of the *Meigs* also reported that numerous obstructions are caused by the method of logging pursued in this river. Rafts floated down without any pilot strike the banks and trees, are broken up, and the heavy woods sink.

Under authority of the Chief of Engineers, the snag boat *Meigs* was transferred to Major Quinn April 27, 1898, for temporary service upon the defensive works at the entrances to Mississippi River, Louisiana.

As the river was approaching a low stage preparations were made in June, 1898, for a party under Overseer John Schuh to commence work early in July at Burtonia, on the river side of Honey Island, and continue removal of obstructions to navigation down to Yazoo City.

The recommendations and estimates contained in my reports of 1894, 1895, 1896, and 1897 respecting the streams of the Yazoo system are repeated, viz:

> Work in Yazoo and tributary streams could be carried on more economically if they were grouped together as a system and appropriations made under one head, with allotments for each stream. The plant could then be bought from the general appropriation and its use charged pro rata without being a heavy burden upon any one stream. A modern dredge, preferably self-propelling, would be of great use in parts of Yazoo, Tchula Lake, and Big Sunflower, but the largest appropriation of late years for any one of the streams mentioned would not be sufficient for the purpose. So also with regard to pile drivers, quarter boats, or small hand-snagging outfits, the idea being to have a district plant, to be used on any of the streams of the system when needed. The estimates are made with this view, the work required not being of a kind that can be done advantageously or satisfactorily by contract. A great deal of work remains to be done in clearing the banks of leaning timber to prevent tree slides and snags and to make the passage of the sharp bends safer, and this can be done most economically by shore parties housed and subsisted on quarter boats, leaving the heavy work to be done at the proper or convenient time by the snag boats. There are also many places where the channel is injured by dispersion, and where chutes should be closed or wing dams built. As Yazoo and tributaries are not subject to heavy drift, work of the kind need not be expensive, and probably sheet piling would answer very well.

DETAILED ESTIMATES.

General service plant:		
Dredge	$30,000	
Pile driver	4,000	
Quarter boats	2,500	
Skiffs, tools, rigging, etc	3,500	
		$40,000
Service of plant:		
Expenses of snag boats	24,000	
Expenses of dredges	9,000	
Expenses of shore parties	7,000	
		40,000
Care of plant:		
New boilers	4,000	
Hull repairs	3,000	
General and extraordinary repairs	1,500	
Fleet, wages, supplies, etc	1,500	
		10,000
Surveys: Local surveys, gauges, discharge measurements, etc		6,000
Administration:		
Office expenses, rent, supplies, etc	1,500	
Assistant engineers, draftsmen, transportation, and incidentals	2,500	
		4,000
Total		100,000

Money statement.

July 1, 1897, balance unexpended	$27,636.87
June 30, 1898, amount expended during fiscal year	10,000.80
July 1, 1898, balance unexpended	17,636.07
July 1, 1898, outstanding liabilities	1.01
July 1, 1898, balance available	17,635.06
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	100,000.00

The appropriations have been as follows:

By act of—	
March 3, 1873	$40,000
March 3, 1875	12,000
August 14, 1876	15,000
June 18, 1878	25,000
March 3, 1879	15,000
June 14, 1880	12,000
March 3, 1881	6,000
August 2, 1882	8,000
July 5, 1884	10,000
August 5, 1886	$15,000
August 11, 1888	32,000
September 19, 1890	25,000
July 13, 1892	20,000
August 18, 1894	20,000
June 3, 1896	20,000
Total	275,000

COMMERCIAL STATISTICS.

Above the present entrance into the Mississippi this river was navigable the entire year. Navigation was interrupted by the sand bar at the mouth during the period September 1, 1897, to January 2, 1898. In the past year the bar formation at the mouth began at stages between 8 and 9 feet upon the Vicksburg gauge.

List of steamboats engaged in navigating Yazoo River during the fiscal year.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
						Light.		Loaded.				
			Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Ruth	Stern-wheel.	319.4	160	31.5	5	3	0	6	6	Vicksburg and Greenwood.	3	40
Annie Laurie	...do	199.81	138	27	4.8	3	0	5	0	.....do	1	10
Memphis *a*	...do	220.25	111	26	4	2	6	5	0	....do Vicksburg and Tallahatchie River.	16 1	100 ....
Lake Palmyra *a*	...do	141.16	123.5	26	4.8	3	0	4	6	Vicksburg and Gandercleugh. Vicksburg and Big Sunflower River.	1 6	....
Atlanta *a*	...do	85.03	93	16.4	3.7	2	2	3	0	Vicksburg and Big Sunflower River. Vicksburg and Silver Creek.	5 1	....
Morning Star	...do	86.6	95	20.4	2.4	2	2	3	0	Vicksburg and Yazoo City.	1	....
Mary Joyce *a*	...do	54.2	65	14	2.4	1	1	2	0	Vicksburg and Big Sunflower River.	8	....
Josephine Loviza *b*	...do	93.25	113.6	22.2	3.7	2	4	3	6	.....do	4	....
C. H. Woods	...do	70.83	110	22	3.2	1	8	1	8	(Sawmill boat)	.....	....
Rover	...do	53.07	100	18	3.5	2	0	3	6	.....do	.....	....
Henry Marx *b*	...do	357.35	138	30	4.5	3	6	4	6	Vicksburg and Yazoo River.	4	....
Resolute *b*	...do	207.98	139.6	29	3.9	3	0	4	3	Vicksburg and Greenwood.	2	....
Crescent *b*	...do	239.96	144	28	5	......		......		No report received	.....	....
Thomas A. Hendricks. *b*	...do	81.86	108	22.5	4.2	4	2	5	0	.....do	.....	....
Alarm *b*	...do	189.09	142	26	4.3	......		......		New Orleans and Greenwood.	3	....
Hibernia	...do	157.06	135	25	4	2	0	4	0	Vicksburg and Greenwood. Vicksburg and Big Sunflower River.	1 2	....
Novelty *a*	...do	83.65	76.4	16.4	3	1	6	3	6	Vicksburg and Tallahatchie River. Vicksburg and Big Sunflower River.	1 17	 125
Rees Pritchard	...do	196.2	150.3	31	3.3	1	2	3	8	Vicksburg and Yazoo City. Vicksburg and Tallahatchie River.	9 18	 195
Fifteen *a*	...do	75.0	103	18	3.5	2	0	3	6	Yazoo City and Belzona. Yazoo City and Big Sunflower River.	15 2	50 5

List of steamboats engaged in navigating Yazoo River during the fiscal year—Cont'd.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
						Light.		Loaded.				
			Feet.	*Feet.*	*Feet.*	*Ft.*	*In.*	*Ft.*	*In.*			
Maggie *a*	Stern-wheel.	50.73	85	19	3.5	1	6	3	0	Yazoo City and Vicksburg.	1	....
										Yazoo City and various landings.	65	75
										Yazoo City and Big Sunflower River.	10	25
Water Maiden *a*	...do ..	28.59	69	12	2.6	1	11	2	0	Vicksburg and Yazoo City.	1	....
										Vicksburg and Big Sunflower River.	2	....
Yazonia *a*	...do ..	62.84	95	19.8	3.5	1	3	3	6	Greenwood and Tallahatchie River.	104	....
Mildred *a*	...do ..	19.76	54.5	11	3.2	....		....		Vicksburg and Big Sunflower River.	2	....
Ashland City	...do ..	94.55	120	20	3.9	2	2	4	0	Yazoo City and Vicksburg.	1	....
										Yazoo City and Belzona.	108	300
Mima *a*	...do ..	62.72	66	17	3.2	1	2	2	6	Vicksburg and Greenwood.	1	....
										Vicksburg and Big Sunflower River.	3	....
Rescue	...do ..	135.4	126	24.3	3.7	1	10	3	0	Yazoo City and Vicksburg.	1	....
										Yazoo City and Big Sunflower River.	50	200
Gus Fowler	...do ..	309.62	160	29.5	5.6	2	8	6	0	Vicksburg, Yazoo City, and Greenwood.	19	100
E. A. Pharr	...do ..	95.11	90	29.9	4.5	1	10	3	0	Greenwood and various landings.	104	200
Ferd R *a*	...do ..	45.58	93.8	16.2	3	2	0	3	0	.....do	104	95
Electric	...do ..	34.57	77.6	20	2.8	....		....		Greenwood and Tallahatchie River.	1	....
										Greenwood and Yazoo City.	1	....
										Yazoo City and New Orleans.	1	....
Joe Seay *b*	Tug ..	27.74	75	16	6	7	0	8	0	Vicksburg and mouth.	5	....

a With one or more barges.

b Towboat.

NOTE.—The Mississippi River packet *Annie Laurie* made the run from Vicksburg to Greenwood in 27 hours.

The following wrecks occurred in Yazoo River during the year, viz: Steamer *Fifteen*, sunk October 30, 1897, at head of Honey Island; sawmill steamboat *Rover*, sunk November 13, 1897, opposite Vanland Landing.

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	11,571	21,163	14,403	17,037
Cotton seed	28,765	32,147	17,150	19,432
Hides and skins	2	12	12	11
Live stock	25	120	52	47
Lumber	600	2,450	1,613	10,080
Staves	12,156	14,264	23,740	10,623
Provisions	2,750	14,175	13,520	13,325
Grain	7,000	7,380	7,018	13,760
Saw logs	11,000	40,200	31,200	11,000
Miscellaneous	8,220	15,400	18,863	17,725
Total freights for Yazoo proper	82,089	147,311	127,571	113,040
Total freights from tributaries	43,101	57,546	85,374	107,551
Total freight Yazoo and tributaries	125,190	204,857	212,945	220,591
Estimated value	$2,840,000	$3,218,000	$3,619,000	$4,806,000

Summary of commerce reported—Continued.

Articles.	1893–94.	1892–93.	1891–92.	1890–91.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	15,815	11,094	15,653	13,750
Cotton seed	17,355	12,795	16,570	12,500
Hides and skins	10	26	19	10
Live stock	60	79	124	60
Lumber	3,200	3,122	3,318	3,600
Staves	14,447	12,488	6,864	1,350
Provisions	12,020	8,547	10,502	9,020
Grain	14,280	6,107	12,531	11,080
Saw logs	22,400	11,800	15,000	2,140
Miscellaneous	12,200	8,507	12,624	10,540
Total freights for Yazoo proper	111,787	74,565	93,205	64,050
Total freights from tributaries	136,394	124,887	116,021	97,588
Total freights Yazoo and tributaries	248,181	199,452	209,226	161,638
Estimated value	$8,314,000	$4,329,000	$7,351,500	$6,315,275

Receipts and shipments of bales of cotton at Greenwood and Yazoo City, Miss.

Routes.	Greenwood.			
	1897–98.		1896–97.	
	Receipts.	Shipments.	Receipts.	Shipments.
Southern Rwy	18,480	33,080	9,962	19,962
Illinois Central R. R	8,107	25,570	4,521	17,006
River	21,843	250	20,808	396
Wagon	13,373	....	2,500	....
Total	61,803	58,900	37,791	37,364

Routes.	Yazoo City.			
	1897–98.		1896–97.	
	Receipts.	Shipments.	Receipts.	Shipments.
Illinois Central R. R	22,388	77,495	13,353	56,102
River	43,219	16,911	22,618	2,309
Wagon	30,807	....	23,292	....
Total	96,414	94,406	59,263	58,411

When the mouth of the river is closed to navigation, the sources of supplies for Yazoo and tributaries are Yazoo City and Greenwood.

The Georgia Pacific division of the Southern Railway crosses Yazoo River at Fort Loring, 5 miles below Greenwood, and the Yazoo and Mississippi Valley Railroad crosses about 15 miles above the mouth. The latter has a branch from Clarksdale to Philipp, on the Tallahatchie, connecting with a branch of the Georgia Pacific to Greenwood. The Yazoo branch of the Illinois Central Railroad, from Parsons, on the Yallabusha, to Jackson, Miss., runs parallel to the river, touching at Greenwood, Sidon, Tchula, and Yazoo City, and has a tap line from Tchula to the main line at Durant. The Yazoo and Mississippi Valley Railroad is extending the Tallahatchie branch to and across Yallabusha River, to connect with the Yazoo branch of the Illinois Central a short distance north of Greenwood and give a through line from Clarksdale to Greenwood, and it is understood that the same road contemplates building another line down the east side of Big Sunflower River from an intersection with the Tallahatchie branch.

W 9.

IMPROVEMENT OF MOUTH OF YAZOO RIVER AND HARBOR AT VICKSBURG, MISSISSIPPI.

Operations during the year were as follows:

In July, 1897, a ditch was dug at the outlet of McNutt Lake to drain water ponded by the line of embankment along the canal, and about 1,300 cubic yards of earth were excavated for the purpose; soundings and discharge measurements were taken at the present mouth of Yazoo to determine changes at that locality; elevations of high-water marks of 1897 were determined by levels; the road along the canal bank was repaired and put in passable condition, and cross sections of the canal site were made. In August and September the reference signs along the diversion route were repaired. Owing to strict local quarantine, due to the yellow-fever epidemic near Vicksburg, communication with the work was stopped from the latter part of September until November 3, during which period nothing could be done. In November a low-water survey of present mouth of the Yazoo was made, and shore line, soundings, and discharge were taken. Work for repairing and altering the reference signs, necessitated by damages sustained during the flood of 1897, was resumed in November and continued with a small force until January. Proposed levee lines, under a recent act of the legislature of Mississippi, along Chickasaw Bayou and Yazoo River to Steele Bayou were located and mapped in March and April. The quarter boat was repaired and moved to upper end of the canal in April.

Attention is invited to the appended report of Assistant Engineer H. M. Marshall, giving details of the work done, and containing a revised estimate of the amount of excavation required, etc.

On February 11, 1897, I submitted a project for operations by the method called continuous contracts. The work to be advertised was to be contract No. 3, and to cover excavation, by any method the contractor might choose, of the line of canal between Lake Centennial and Old River, depositing some of the material behind the embankments now raised upon the right of way on either side, part in the "wrong end of Old River" below the line of the canal, and part across Lake Centennial below the line of the canal from the west shore of the lake to the head of the former point of bend in Louisiana, now called De Soto Island; excavating and dredging from a point in the deeper water above the dam built by the Mississippi River Commission from the Vicksburg shore to De Soto Island; removal of part of the dam, and excavating and dredging along the line of the canal in front of Vicksburg, begun by the Mississippi River Commission, to deep water at Kleinston, the present lower steamboat landing for Vicksburg at stages below, say 25 feet on the Vicksburg gauge; the material to be deposited beyond and westward of the canal, either in the lake or so far as not to slide in or weigh the banks to such an extent as to force up the bottom, on the line of deposit across Lake Centennial, if such deposit should be made, or wherever the engineer in charge may reasonably order; dredging or excavating in the "wrong end of Old River" from deep water to join the canal across to Lake Centennial, and deposit of material westward or below at safe distance.

The project for excavation and dredging was approved by the Secretary of War February 1, 1898, but the advertisement for bids was delayed until the amount of levee work could be ascertained. The levee commission having failed to organize, it is now proposed to leave that part of the project in abeyance until another appropriation shall permit its consideration, and to devote all of the available funds to the proposed contract No. 3. Specifications have been prepared and advertisement for proposals will be issued at an early date for the whole work, active operations to begin within six months of the date of acceptance.

Money statement.

July 1, 1897, balance unexpended	$524, 151. 35
June 30, 1898, amount expended during fiscal year	9, 398. 96
July 1, 1898, balance unexpended	514, 752. 39
July 1, 1898, outstanding liabilities	59. 65
July 1, 1898, balance available	514, 692. 74
Amount (estimated) required for completion of existing project	510, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1900	510, 000. 00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

List of appropriations made.

Date of act.	Purport.	Amount.
July 13, 1892	Improving mouth of the Yazoo River, Mississippi, in accordance with plan of Capt. J. H. Willard, dated February 4, 1892, contained in House Ex. Doc. No. 125, Fifty-second Congress, first session, including borings and gauges. Should the Secretary of War be unable to obtain such right of way as may be necessary in the prosecution of this work, upon reasonable terms, by agreement, purchase, or voluntary conveyance, he is hereby authorized to apply at any term of the circuit or district court of the United States for the western division of the southern district of Mississippi, and in the name of the United States institute and carry on proceedings to condemn such lands as may be necessary for right of way as aforesaid, and in such proceedings said court shall be governed by the laws of the State of Mississippi, so far as the same may be applicable to the subject of condemning private property for public use.	$75, 000
Aug. 18, 1894	Improving mouth of the Yazoo River, Mississippi, continuing improvement, to be expended in accordance with plan of Capt. J. H. Willard, as set out in House Ex. Doc. No. 125, Fifty-second Congress, first session	225, 000
Do	Improving harbor at Vicksburg, Miss., not including work at Delta Point, Louisiana, continuing improvement under the direction of the Secretary of War	40, 000
June 4, 1897	For continuing improvement of mouth of Yazoo River and harbor of Vicksburg	350, 000
	Total	690, 000

The river and harbor act of June 3, 1896, provided for completion of the work by the following item, viz:

> Improving mouth of Yazoo River and harbor of Vicksburg, Miss.: For the purpose of completing the project of improvement as heretofore adopted and entered upon, in addition to expending the balance on hand, contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the same, or said materials may be purchased and work may be done otherwise than by contract, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $860,000, exclusive of the amount heretofore appropriated.

Payments for obligations that may be incurred under this act are limited by section 5, as follows:

> SEC. 5. That under the authority to make contracts for materials and work, under the provisions of this act, in addition to the sums appropriated herein, the Secretary

of War shall not obligate the Government to pay, in any one fiscal year, beginning July 1, 1897, more than $400,000 upon the said contracts for any one of the works herein placed under the contract system, except as herein otherwise specifically authorized to do: *Provided,* Any part of the annual allotment herein provided for, not earned and paid for material furnished or work done in one fiscal year, may be paid for material furnished and work done under the contracts in any subsequent fiscal year: *Provided further,* That nothing herein contained shall be so construed as to prevent the Secretary of War from making contracts for the whole or any part of the works placed under the contract system in such manner as may be deemed best, payments, however, to be made as stated in this section.

COMMERCIAL STATISTICS.

During the fiscal year the canal or harbor from Kleinston to the city landing at the foot of Crawford street was completely closed to navigation during the following periods: July 1 to 8 and July 14 to December 31, 1897; and January 1 to 21, 1898. The gauge heights required for the various boats to reach the city landing have been approximately as follows: The Vicksburg and Delta ferryboat, 23.6 feet; the wharf boat, 28.5 feet; the tributary packets, 28.5 feet; the Anchor Line and Mississippi River packets, 29 to 32 feet.

List of steamboats arriving at and departing from Vicksburg during the fiscal year 1898.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft.		Arrivals.	Departures.	Passengers.
						Light.	Loaded.			
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
Hill City	Side-wheel.	1,038.25	275	45	8	3 8	......	20	20	147
City of New Orleans	...do...	1,586.28	290	48	8.5	3 6	9 6	6	6	61
City of St. Louis	...do...	1,614.02	300	49	8.8	3 6	9 0	17	17	112
Bluff City	Stern-wheel.	1,062.38	225	42	6	3 0	8 0	5	5	72
John K. Speed	...do...	1,090.27	261	42	8.6	3 6	10 0	12	12	47
New South	...do...	846.55	257	42.6	7	4 0	10 0	15	15	40
State of Kansas	...do...	1,130.34	252	52.6	6	2 6	7 0	19	19	27
Buckeye State	...do...	669.92	252.3	39.2	6.8	3 0	9 0	9	9	26
City of Savannah	...do...	335.55	186	31	5	3 0	6 0	26	26	1,170
Warren	...do...	316.5	184	37.6	7	3 2	8 0	7	7	
Ouachita	...do...	457.45	189	38	6.5	4 0	9 6	12	12	
Eugene	...do...	570.05	170	34	4.4	1 6	4 0	8	8	62
Ferd. Harold	...do...	900.58	244.6	34	7.2	4 0	9 0	2	2	14
Natchez	...do...	584.99	225	40	8	4 0	8 6	11	11	450
T. P. Leathers	...do...	509.47	220	40	6.5	4 0	9 0	80	80	550
Pargoud	...do...	654.38	242	43	7.6	4 6	9 6	9	9	150
John Howard	...do...	447.52	184.6	37.8	6.3	3 0	7 6	1	1	......
Annie Laurie	...do...	199.81	138	27	4.8	3 0	5 0	99	99	6,000
Ruth	...do...	319.4	160	31.5	5	3 0	6 6	76	76	3,000
Belle of the Bends	Side-wheel.	658	210	32	7	3 6	7 0	22	22	1,700
St. Joseph	Stern-wheel.	277.13	170	32	4.9	3 0	7 6	156	156	20,000
John A. Wood *a*	...do...	687.52	198	40	7	......	......	1	1	......
Rees Pritchard *b*	...do...	196.2	150.3	31	3.3	1 9	4 0	24	24	......
Lake Palmyra *b*	...do...	141.16	123.5	26	4.8	3 0	4 6	48	48	157
Novelty *b*	...do...	83.65	76.4	16.4	3	1 6	3 6	37	37	......
Atlanta *b*	...do...	85.03	93	16.4	3.7	2 2	3 0	14	14	......
Hibernia *b*	...do...	157.06	135	25	4	2 0	4 0	5	5	......
Memphis *b*	...do...	220.25	111	26	4	2 6	5 0	19	19	......
Yazonia *b*	...do...	62.84	95	19.8	3.5	1 3	3 6	2	2	......
Mary Joyce *b*	...do...	54.20	65	14	2.4	1 1	2 0	8	8	......
Mima *b*	...do...	62.72	66	17	3.2	1 2	2 6	5	5	......
Mildred *b*	...do...	19.76	54.5	11	3.2	......	......	2	2	......
Maggie *b*	...do...	50.73	85	19	3.5	1 6	3 0	1	1	......
Water Maiden *b*	...do...	28.59	69	12	2.6	1 11	2 0	11	11	......
Morning Star	...do...	86.6	95	20.4	2.4	2 2	3 0	1	1	......

a Towboats. *b* With one or more barges.

List of steamboats arriving at and departing from Vicksburg, etc.—Continued.

Name.	Class.	Tonnage.	Length.	Breadth.	Depth.	Draft. Light.	Draft. Loaded.	Arrivals.	Departures.	Passengers.
			Feet.	*Feet.*	*Feet.*	*Ft. In.*	*Ft. In.*			
Rescue *b*	Stern-wheel.	135.4	126	24.3	3.7	1 10	3 0	5	5	....
Ashland City *b*	...do...	94.55	120	20	3.9	2 2	4 0	1	1	....
Gus. Fowler	...do...	309.62	160	29.5	5.6	2 8	6 0	20	20	....
Victoria	Launch	....	47.5	16	2.4	....	....	2	2	....
Rambler	...do...	5	35	7.5	4.5	....	....	(*c*)	(*c*)	....
Mattie M	Stern-wheel.	144.25	95	24	2.8	1 8	3 6	(*d*)	(*d*)	11,000
Josephine Loviza *a*	...do...	93.25	113.6	22.2	3.7	2 4	3 6	4	4	....
Joe. Seay *a*	Tug.	27.74	75	16	6	7 0	8 0	(*e*)	(*e*)	....
J. B. O'Brien *a*	...do...	44.49	70.8	15.2	7	7 0	9 0	....	....	....
T. A. Hendricks *a*	Stern-wheel.	81.86	108	22.5	4.2	4 2	5 0	3	3	....
Resolute *a*	...do...	207.78	139.6	29	3.9	3 0	4 3	9	9	....
Crescent *a*	...do...	239.96	144	28	5	....	....	13	13	....
Henry Marx *a*	...do...	357.35	138	30	4.5	3 6	4 6	6	6	....
Alarm *a*	...do...	189.09	142	26	4.3	....	....	2	2	....
G. W. Lyon *a*	...do...	124.67	109	20	2.5	....	....	1	1	....
Titan	...do...	210.25	142	27	6	....	....	1	1	....
Ruby	...do...	49	77	16.9	3.3	....	....	1	1	....
C. B. Bryan	...do...	330.44	114.2	29	4.5	2 0	4 2	1	1	....
Electra	...do...	438	190	40	5.2	2 0	7 0	1	1	....
Sunrise	...do...	473.31	200	45	6.5	2 0	7 6	1	1	....
Elk	...do...	111.22	153	22	4	2 0	4 0	2	2	....
Janie Rae	...do...	119.05	110	25.9	3	....	....	1	1	....
Shawnee	Yacht.	21.49	50	10	3	....	....	1	1	....
Defender *a*	Stern-wheel.	514.85	177	41	7.3	....	....	1	1	....
Boaz *a*	...do...	623.3	193	44.4	6.5	....	....	1	1	....
Henry Lowrey *a*	...do...	646.79	209.6	35.2	5.8	....	....	1	1	....
J. N. Macomb	Side-wheel.	800	176.9	62	7	....	....	5	5	....
Joseph Henry	...do...	340	180	32	5.8	....	....	6	6	....
Meter	Stern-wheel.	39	85	17	3.6	....	....	1	1	....
Search	...do...	49.8	120.5	22.5	4.0	....	....	2	2	....
Mississippi	...do...	390.14	174	32	6	....	....	3	3	....
Minnetonka	...do...	381.63	176.5	29.9	5.4	....	....	1	1	....
John R. Meigs	...do...	330	172	38	5	2 10	4 0	4	4	....
Grey Eagle	...do...	555.59	250	40	5.5	4 0	9 0	1	1	5
Waikiki	Yacht.	18.6	49.6	9.1	3.5	....	....	1	1	....

a Towboats. *b* With one or more barges. *c* Harbor launch.
d Ferryboat. *e* Harbor tug.

Summary of commerce reported.

Articles.	1897–98. Yazoo River and tributaries.	1897–98. Mississippi River.	1897–98. Total.
	Tons.	*Tons.*	*Tons.*
Cotton	15,120	7,129	22,249
Cotton seed	40,706	29,365	70,071
Coal	....	15,000	15,000
Lumber	1,070	3,069	4,139
Saw logs	21,000	10,000	31,000
Staves	26,239	1,362	27,601
Live stock	76	3,514	3,590
Hides and skins	5	238	243
Grain	7,240	20,913	28,153
Provisions	4,587	19,987	24,574
Miscellaneous	9,147	14,869	24,016
Total	125,190	125,446	250,636
Estimated value	$1,826,000	$5,450,000	$7,276,000

Summary of commerce reported—Continued.

Articles.	1896-97. Yazoo River and tributaries.	Mississippi River.	Total.
	Tons.	*Tons.*	*Tons.*
Cotton	25,913	5,364	31,277
Cotton seed	44,449	17,127	61,576
Coal		15,000	15,000
Lumber	3,924	7,130	11,054
Saw logs	46,200	34,500	80,700
Staves	27,730	730	28,460
Live stock	696	4,411	5,107
Hides and skins	31	111	142
Grain	7,741	12,790	20,531
Provisions	21,448	21,851	43,299
Miscellaneous	26,725	17,396	44,121
Total	204,857	136,410	341,267
Estimated value	$3,218,000	$4,756,600	$7,974,600

Articles.	1895-96. Yazoo River and tributaries.	Mississippi River.	Total.
	Tons.	*Tons.*	*Tons.*
Cotton	20,193	4,911	25,104
Cotton seed	29,161	13,498	42,659
Coal		15,000	15,000
Lumber	4,487	2,036	6,523
Saw logs	37,000	30,000	67,000
Staves	63,762	180	63,942
Live stock	191	240	431
Hides and skins	33	133	166
Grain	7,443	21,325	28,768
Provisions	20,450	15,495	35,945
Miscellaneous	30,225	14,400	44,625
Total	212,945	117,218	330,163
Estimated value	$3,619,000	$4,088,000	$7,707,000

Receipts and shipments of cotton at Vicksburg, Miss.

	1897-98.	1896-97.
	Bales.	*Bales.*
Receipts	93,185	80,597
Shipments	89,929	80,026

The Vicksburg cotton-seed oil mills report the total number of sacks of cottonseed received by river during last fiscal year as 803,720, as compared with 594,300 sacks received during the fiscal year ending June 30, 1897.

Receipts and shipments reported by railroads.

Articles.	1897–98.			
	Alabama and Vicksburg and Vicksburg, Shreveport and Pacific railroads.		Yazoo and Mississippi Valley Railroad.	
	Received.	Shipped.	Received.	Shipped.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	37,908	22,822	6,074	29,902
Cotton seed	2,604	270	13,940	....
Coal	44,499	33,385	5,400	....
Lumber	10,458	7,105	3,840	9,712
Staves	2,655	4,580	....	....
Live stock	5,686	6,920	3,546	804
Grain	12,562	13,830	11,895	5,239
Provisions	17,129	11,690	17,620	6,856
Miscellaneous	44,794	53,516	44,228	35,350
Total	178,295	154,118	106,543	87,863

Articles.	1896–97.			
	Alabama and Vicksburg and Vicksburg, Shreveport and Pacific railroads.		Yazoo and Mississippi Valley Railroad.	
	Received.	Shipped.	Received.	Shipped.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	28,195	38,710	6,235	25,900
Cotton seed	4,341	....	13,120	....
Coal	33,666	32,948	3,330	....
Lumber	4,648	1,413	2,960	7,220
Staves	....	....	....	....
Live stock	1,191	197	1,964	780
Grain	7,877	36	10,900	5,450
Provisions	77,062	5,469	12,726	6,875
Miscellaneous	18,495	67,474	41,457	32,666
Total	175,475	146,247	92,692	78,891

Articles.	1895–96.			
	Alabama and Vicksburg and Vicksburg, Shreveport and Pacific railroads.		Yazoo and Mississippi Valley Railroad.	
	Received.	Shipped.	Received.	Shipped.
	Tons.	*Tons.*	*Tons.*	*Tons.*
Cotton	27,155	10,255	4,770	26,015
Cotton seed	3,171	....	12,414	....
Coal	....	26,007	4,520	....
Lumber	6,428	3,586	2,120	5,450
Staves	....	755	1,470	....
Live stock	418	1,163	....	520
Grain	3,130	6,225	4,732	2,392
Provisions	10,771	6,382	8,455	6,205
Miscellaneous	14,413	77,686	35,341	28,835
Total	65,486	132,059	73,822	69,417

	1897–98.	1896–97.	1895–96.
	Tons.	*Tons.*	*Tons.*
Total receipts by railroads	284,838	268,167	139,308
Total shipments by railroads	241,981	225,138	201,476

REPORT OF MR. H. M. MARSHALL, ASSISTANT ENGINEER.

U. S. Engineer Office,
Vicksburg, Miss., June 30, 1898.

Major: I have to report upon improving Yazoo River, Mississippi, at the mouth.

At the beginning of the fiscal year the extreme high water of 1897 had just subsided. The highest elevation attained was 36.56 meters, Cairo datum, at the head of the Diversion Canal on Old River and 36.11 meters at the foot on Lake Centennial. The water had run through 3.31 meters deep at the head and 6.11 meters at the foot, with a swift current in the upper part where the levees directed the flow. Much to the chagrin of many there was no scour where the excavation had been made. Over that part where the levee is incomplete or wanting a cross current flowed bringing in drift, wrecking the reference signs, and destroying the roadway along the canal site, thereby demonstrating the necessity for closing these gaps and raising the grade above overflow.

During July a survey was made at the present entrance of the Yazoo into the Mississippi while the water surface was 27.19 meters, Cairo datum. It was duplicated in November with the water 19.82 meters. The earlier sounding covered that part of the bar through which Yazoo River had previosly scoured its bed every year as Mississippi River fell, but from some unknown cause this year the Yazoo took a new departure and broke away at right angles, forming a new debouchment after traversing only about half its usual course. A comparison of surveys (plates 1 and 2), contains the cross sections, shows that as far as the river flowed over the first measured bed it had deepened in the interim from 2 to 5 meters, and had scoured and carried away about 150,000 cubic meters. It is safe to expect that the bar at the present mouth will be left at about 22.5 meters, Cairo datum, or about 3 meters above low water immediately upon the completion of the canal. It is also reasonable to expect very considerable scour in the bottom of the canal near where it shall enter the Mississippi.

Considerable ditching had to be done to drain the water which was dammed by the levee along the line of the canal. It will, however, not prove a difficult task to drain all the water which falls within the proposed levee into McNutt Lake, from which it can escape during low water into Chickasaw Bayou through a suitable outfall.

Preliminary survey has been made for a part of the projected levee from Steeles Bayou along Yazoo River and Chickasaw Bayou to the hills. The rest of the line has not been run because of sickness of Mr. F. D. Nash, who was running the instrument, and because of interference by high water. A map was made showing property lines within the proposed levee. The construction of a levee along the bank of the projected cut from Lake Centennial to Old River, and thence along the bank of the latter to or near the former mouth of Yazoo, has from the beginning been part of the project for the improvement of Yazoo River at the mouth. It is an essential feature for the control of the high-water flow, without which, failure of the plan is inevitable, for no channel can be maintained with a crossflow like that of 1897.

The building of a levee from the lower end of the cut along the bank of Lake Centennial to the high land back of the fair ground is highly desirable as a further means of control of the high water. Because the land between Yazoo River and Lake Centennial might be actually damaged by increase of current due to building the first-mentioned line, or by ponding of water if both lines should be built, it was decided best to continue the levee up Yazoo to a junction with the hills, provided all questions of damages by the United States could thereby be eliminated, and also provided the cost of this additional length of levee could be offset by obtaining all the right of way without expense. To compass these ends the proprietors interested had an act passed by the legislature creating the Yazoo-Chickasaw Levee district with power to act in conjunction with the United States authorities. When the question of drainage for the rainfall within the area was looked into it was seen that the very large hill area which has its run-off through Big and Little Chickasaw bayous into Yazoo would be inimicable to the interests sought to be protected. On this account it was decided to deflect the levee and follow Chickasaw till the hills could be reached by a crossing which would exclude the run-off. As soon as the levee shall be located and request made to the district levee board they doubtless will be able to acquire the right of way, by condemnation, through the lands of the three proprietors who oppose the building.

The canal through the main cut has been excavated to the 30-meter plane above Cairo datum from the lower end to Barnett Lake. The bed of that lake is about on the 25-meter plane, and from its upper end the excavation has over part been made to the 32.5 and over the rest to 33.25 meter plane.

The following tables show the amounts to be excavated from the several portions of the canal between planes of successive elevations, and the occurrence and duration of water surfaces suited to do the dredging.

Table showing quantities in cubic meters to be excavated from the Yazoo Diversion Canal between stated elevations.

[Elevations in meters, Cairo datum.]

Locality.	18-20.	20-22.	22-24.	24-26.	26-28.	28-30.	30-32.	32-34.	Total.
Old River	....	....	21,825	....	....	....	....	....	21,825
Main cut		438,000	576,925	709,850	786,715	673,280	302,748	125,600	3,613,118
Lake Centennial		148,895	179,000	148,750	100,900	10,350	....	....	587,895
Vicksburg Harbor	266,583	362,590	368,314	276,709	169,300	82,100	13,250	....	1,538,846
Total	266,583	949,485	1,146,064	1,135,309	1,056,915	765,730	315,998	125,600	5,761,684

Table showing average gauge reading in feet each month at Vicksburg, Miss.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1872	7.91	4.82	15.97	29.89	30.34	31.09	21.05	17.97	18.20	4.60	3.30	1.19
1873	12.89	24.29	35.93	36.48	39.74	37.17	27.89	15.60	7.14	3.83	6.73	25.10
1874	27.35	33.03	41.00	44.27	44.82	29.50	15.86	10.71	7.67	7.16	4.29	8.66
1875	17.10	22.04	33.93	42.55	39.97	28.91	34.22	40.23	26.34	14.95	10.51	21.94
1876	34.59	41.15	40.93	43.22	44.62	40.57	39.26	26.12	21.23	18.23	13.08	9.04
1877	10.81	29.10	21.78	37.98	41.31	39.31	34.27	17.85	(*a*)	(*a*)	16.04	22.29
1878	29.36	33.12	39.82	33.29	39.58	37.43	30.68	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)
1879	21.61	37.97	30.62	34.96	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)
1880	37.22	34.29	42.59	42.67	37.48	24.35	30.14	(*a*)	(*a*)	8.77	(*a*)	(*a*)
1881	15.20	34.04	41.28	41.10	41.09	31.11	31.06	12.34	4.65	15.21	26.57	29.67
1882	39.51	43.87	47.68	45.15	41.65	41.33	39.81	24.21	14.28	9.81	10.33	9.04
1883	16.86	35.42	42.82	43.25	40.38	39.10	37.06	21.70	7.69	5.55	18.56	24.98
1884	32.71	39.11	46.33	45.83	44.87	34.13	24.24	15.17	7.46	13.92	9.78	10.17
1885	36.54	36.61	28.64	33.15	37.00	30.03	28.34	16.46	17.84	9.59	15.87	13.75
1886	23.14	29.07	32.92	38.79	43.12	31.91	23.72	10.64	6.25	3.19	.44	12.78
1887	12.91	34.87	43.78	34.52	33.48	19.54	13.49	4.33	.93	.31	— 3.03	1.33
1888	13.40	22.04	28.17	40.98	33.36	32.72	28.20	15.62	20.00	6.65	20.83	15.44
1889	23.62	28.27	30.01	26.71	15.40	26.19	25.99	18.96	9.40	3.32	10.93	23.65
1890	29.91	44.72	46.92	48.02	45.57	35.45	21.55	10.42	13.01	19.39	19.30	16.90
1891	27.63	37.30	46.64	47.70	36.46	23.59	24.41	17.98	10.25	.02	— .85	11.98
1892	21.93	28.65	30.99	41.31	48.15	47.84	42.36	20.08	7.78	1.55	.88	12.73
1893	15.44	19.65	40.92	36.01	46.42	45.24	27.16	8.14	2.60	2.17	1.59	4.50
1894	10.96	28.38	37.18	36.93	30.23	21.91	13.67	3.82	1.01	— 1.67	— 5.03	.98
1895	11.71	13.19	17.80	24.72	13.93	9.52	14.08	11.39	5.71	— 3.34	— 5.87	1.73
1896	20.16	23.97	21.31	35.06	21.11	28.91	20.90	24.53	5.87	4.20	4.05	13.65
1897	19.45	25.93	41.67	50.99	49.15	27.55	21.27	15.27	4.55	— 1.43	— 2.45	3.86
Mean	21.92	30.19	35.68	39.06	37.57	31.77	26.83	16.50	9.99	6.35	7.65	12.84

a No record.

Table showing by months the total number of days of duration and number of times of occurrence of certain phases of water surface at Vicksburg, Miss.

[Elevations in meters, Cairo datum.]

Month.	Water surface between—									
	18-20.		20-22.		22-24.		24-26.		26-28.	
	Days.	Times.	Days.	Times.	Days.	Times.	Days.	Times.	Days.	Times.
October *c*	114	7	297	17	171	12	100	8	31	4
November *c*	144	6	202	10	134	13	116	10	66	7
December *c*	54	5	136	10	182	14	138	15	126	13
January *a*	9	2	49	5	118	14	183	21	145	20
February *a*	....	....	26	2	38	5	41	8	107	13
March *a*	....	....	7	1	5	2	64	5	54	9
April *a*	....	....	....	....	....	....	....	....	52	4
May *b*	....	....	....	....	18	1	42	4	42	7
June *b*	....	....	....	....	30	1	36	4	121	10
July *b*	....	....	....	....	32	4	148	12	179	17
August *c*	....	....	68	4	196	17	224	18	144	13
September *d*	....	....	239	15	254	15	83	8	73	5

Table showing, by months, the total number of days of duration and number of times of occurrence of certain phases of water surface at Vicksburg, Miss.—Continued.

SUMMARY OF YEARLY DURATION.

[Number of days.]

Maximum	76	117	114	87	101
Minimum	0	0	26	18	21
Mean	*d* 14½	*d* 45⅔	*d* 51⅔	*c* 50½	*a* 46

Gauge record covers: *a* 26 years, *b* 25 years, *c* 23 years, *d* 22 years.

[Elevations in meters, Cairo datum.]

Month.	Water surface between—									
	28–30.		30–32.		32–34.		34–36.		36–38.	
	Days.	Times.	Days.	Times.	Days.	Times.	Days.	Times.	Days.	Times.
November *c*	24	4	4	1						
December *c*	53	7	24	2						
January *a*	134	18	117	12	51	4				
February *a*	167	20	187	19	161	12	8	1		
March *a*	140	11	128	15	299	15	109	5		
April *a*	86	10	187	13	326	19	127	7	2	1
May *b*	89	9	82	10	375	19	127	7		
June *b*	197	14	158	17	163	13	45	2		
July *b*	197	17	123	12	93	6	3	1		
August *c*	38	5	14	4	29	1				
September *d*	3	1	5	1	3	1				

SUMMARY OF YEARLY DURATION.

[Number of days.]

Maximum	104	93	161	87	2
Minimum	5	0	0	0	0
Mean	*a* 44¾	*a* 39⅔	*a* 57⅔	*a* 16⅑	*a* $\frac{1}{13}$

Gauge record covers: *a* 26 years, *b* 25 years, *c* 23 years, *d* 22 years.

It will be seen that with a capacity of 200,000 cubic meters per month the dredging could not be carried quite to the 28-meter plane during an average high water. Since it is useless to dredge the lower planes before the higher ones are finished, the dredging would stop when the water should fall below 28 meters. The next season the dredge would be shut out before the 24-meter plane was reached. From which it is clear the water in Lake Centennial must not be permitted to fall below the 28-meter plane during the first year after the dredging is begun. This can be accomplished by filling West Pass and the mouth of the Vicksburg Harbor canal with dredged material while the water is above that plane; that is, dredge through the old dike across the upper end of the Vicksburg Harbor and dump the mud at the points named. The dam to be built across the west arm of Lake Centennial will consume so much of the material taken from the main cut that the distance will become too great to deliver it by piping, therefore scows will be used. The levees along the canal have been partly built with the trees still standing, with the expectation that so much material would be wasted from the canal that the whole land would be raised and the trees could do no harm. To continue this plan pumping will be required. Hence in making contracts both styles of dredging should be provided for and prices should be bid for excavation in scows and in place. The measurement for the latter should be done immediately in front of and behind the dredging. During the high water of the past spring the hull of the survey quarter boat was sheathed and boat was floated to the upper end of the main cut and beached. If the cabin is raised on top the levee and a floor put under it a very good house for quarters for engineer inspectors will be available at a point most convenient to the work.

The following tables give maximum gauge heights at Cairo and Vicksburg each year since the record began and the number of days the river stood above 30 feet and above 40 feet; also the average monthly reading at Vicksburg.

Very respectfully, your obedient servant,

H. M. MARSHALL, *Assistant Engineer.*

Maj. J. H. WILLARD,
Corps of Engineers, U. S. A.

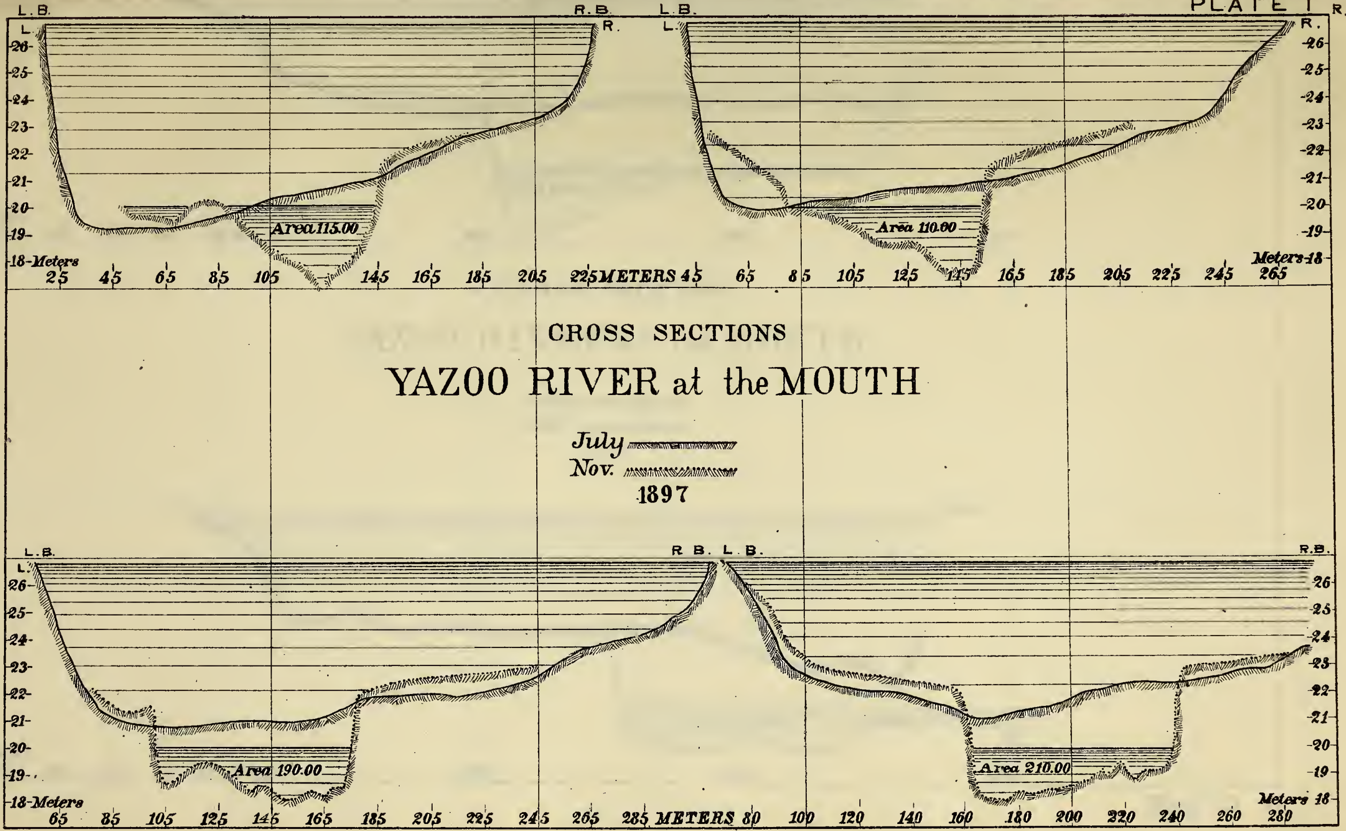
Table showing height and duration of floods at Cairo, Ill., before and after completion of levee system in 1885.

Year.	Date.	Maximum gauge reading.	Number of days above 30 feet.	Number of days above 40 feet.
		Feet.		
1872	Apr. 19, 20	39.20	18	0
1873	Feb. 26	41.55	87	14
1874	Apr. 26	47.37	99	45
1875	Mar. 21 Aug. 8	43.66 45.12	112	56
1876	Apr. 6, 7	46.38	158	61
1877	Apr. 15	40.52	85	3
1878	Apr. 29	37.04	52	0
1879	Jan. 26	36.00	58	0
1880	Mar. 22	44.60	127	40
1881	Apr. 20	45.80	127	40
1882	Feb. 26	51.87	198	105
1883	Feb. 27	52.17	128	51
1884	Feb. 22–24	51.79	114	57
Mean	Apr. 1	44.50	104.85	36.31
1885	Jan. 26	39.00	60	0
1886	Apr. 19	50.98	76	26
1887	Mar. 9, 10	48.48	72	44
1888	Apr. 4	45.25	44	18
1889	June 24	34.50	18	0
1890	Mar. 12	48.80	132	70
1891	Mar. 3–6	46.20	97	66
1892	Apr. 28	48.30	128	66
1893	May 8–10	49.30	106	61
1894	Feb. 16	37.00	24	0
1895	Jan. 21, 22 Mar. 26	33.00 32.36	16	0
1896	Apr. 13	39.10	62	0
1897	Mar. 25, 26	51.62	100	59
Mean	Mar. 26, 27	43.13	71.92	31.54

Table showing height and duration of floods at Vicksburg, Miss., before and after completion of levee system in 1885.

Year.	Date.	Maximum gauge reading.	Number of days above 30 feet.	Number of days above 40 feet.
		Feet.		
1872	May 2, 3	39.50	63	0
1873	May 29, 30	40.60	147	11
1874	May 2–5	45.70	141	89
1875	Apr. 21 Aug. 16–29	43.00 40.80	160	84
1876	May 10	44.90	210	131
1877	May 8–13	41.60	136	52
1878	Mar. 24–27	40.95	185	33
1879	Feb. 17	39.45	88	0
1880	Apr. 8, 9	43.15	154	73
1881	Mar. 10–12	41.85	149	93
1882	Mar. 20, 21	48.75	215	183
1883	Apr. 7	43.80	162	88
1884	Mar. 25	49.00	177	109
Mean	Apr. 21–23	43.07	152.85	72.77
1885	Feb. 3	42.40	143	34
1886	May 7–9	44.15	100	53
1887	Mar. 26–31	44.70	93	50
1888	Apr. 26	44.18	76	26
1889	July 3	34.43	57	0
1890	Apr. 23, 24	49.05	160	134
1891	Apr. 2–4	48.10	125	87
1892	May 10, 14, 15 June 2–4	48.40	159	107
1893	May 22, 23	48.30	142	94
1894	Apr. 2	40.90	92	13
1895	Apr. 3, 4	31.70	8	0
1896	Apr. 21	39.00	57	0
1897	Apr. 16	52.40	112	83
Mean	Apr. 19–22	43.67	101.85	52.38

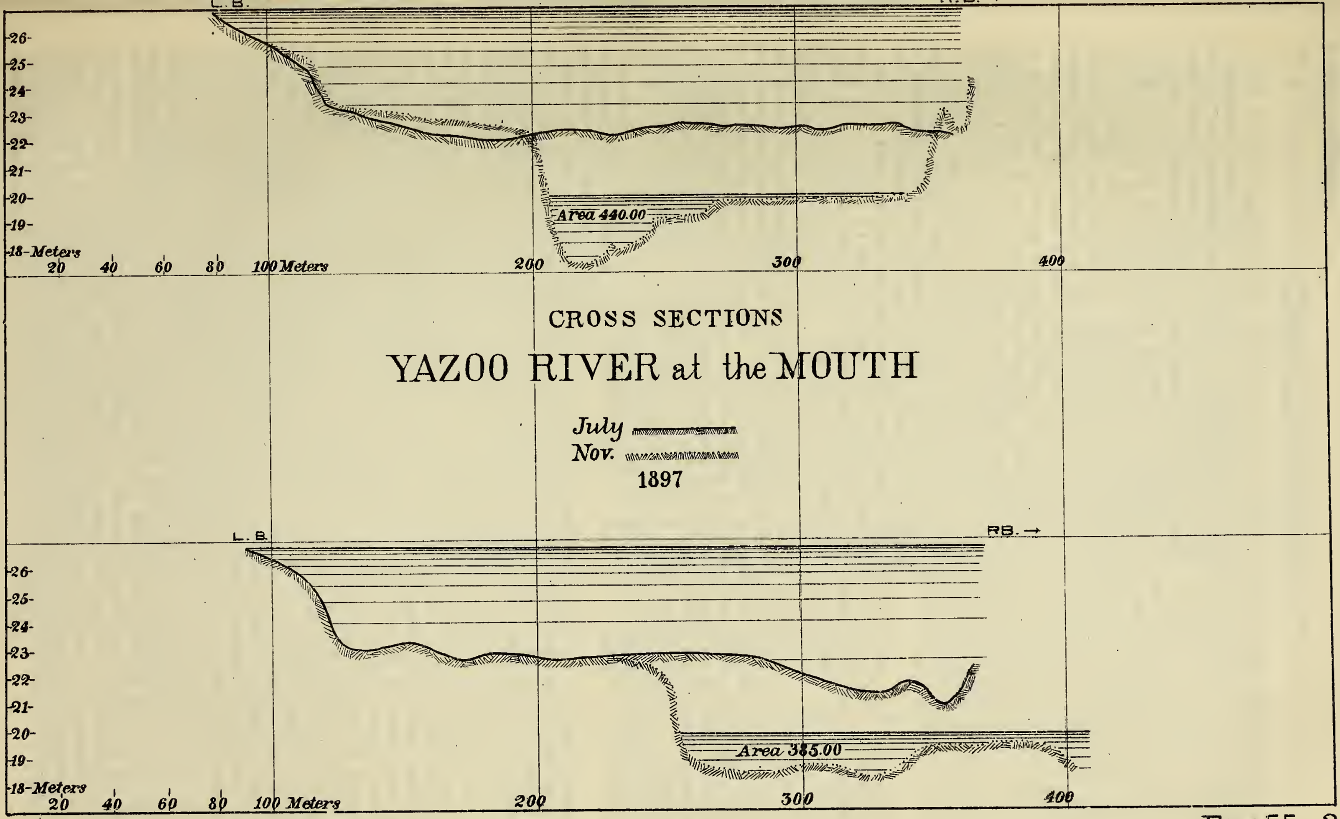
PLATE I



CROSS SECTIONS

YAZOO RIVER at the MOUTH

July
Nov.
1897



CROSS SECTIONS

YAZOO RIVER at the MOUTH

July
Nov.
1897

Eng 55 3

In the spring of 1885 and subsequently levees were continuous on the Mississippi side from Memphis, Tenn., to the mouth of the Yazoo River, Mississippi, and on the Arkansas-Louisiana side from Arkansas City, Ark., nearly to the mouth of the Red River, Louisiana.

AN ACT to create the Yazoo-Chickasaw levee district, constitute its board of levee commissioners, and define the powers and duties thereof.

SEC. 1. *Be it enacted by the legislature of the State of Mississippi,* That the Yazoo-Chickasaw levee district is created, to embrace all the land lying in Warren County within the boundary as follows: Beginning at a point in section 12, township 16 north, range 3 east, district west of Pearl River, where the limit of overflow by the waters of Mississippi River intersects the north bank of Lake Centennial; thence along the bank of said lake in a westerly direction to the lands purchased by the United States and ceded by the State of Mississippi for the purpose of improving the Yazoo River; thence in a northwesterly direction along the northeast boundary of said lands, as recorded in the chancery clerk's office in said county, to its intersection with the bank of the Wrong End of Old River; thence in a northerly direction along the bank of said Old River to the former mouth of Yazoo River; thence in an easterly course along the bank of Yazoo River to the mouth of Chickasaw Bayou; thence in a southerly direction along the banks of Chickasaw Bayou and McNutt Lake to a point where the public road now crosses the said lake at the place called Sherman Bridge; thence in a southerly direction across said lake to the mouth of a drain just west of the public road; thence in an easterly direction along the south bank of said drain to its intersection with the limit of overflow by the waters of Mississippi River; thence along the said limit of overflow near the base of the hills in a southerly direction to the place of beginning.

SEC. 2. That as soon as practicable, and before the first Monday in March in 1898, after the passage of this act, and biennially thereafter the governor of the State shall appoint three owners of land lying within said district, and that such persons, when so appointed, and their successors in office shall constitute, and are hereby declared to be, a body politic and corporate, by the name and style of "The Board of Levee Commissioners for the Yazoo-Chickasaw Levee District," and by that name may sue and be sued, plead and be impleaded, and have perpetual succession for the purpose hereinafter designated. They may have a common seal and alter the same at pleasure, and may from time to time make such by-laws, rules, and regulations, and alter and change the same, as they may deem proper, and do all other acts and things not inconsistent with this act and with the laws of this State for the purpose of carrying into effect the objects and purposes of their incorporation. They shall elect from their own number a president, and appoint a secretary, who shall be treasurer, and such other officers, agents, and attorneys, and employ such persons as they may think necessary for the efficient conduct and management of their business, and remove them at pleasure.

SEC. 3. That the commissioners appointed as aforesaid shall hold their offices for two years from the first Monday in March, 1898, and until their successors are appointed and qualified, and in case of a vacancy the governor shall fill the same by appointment in like manner; and they shall hold their first meeting at Vicksburg, Mississippi, which is hereby declared to be the domicile of said board of levee commissioners, on the first Monday in March, 1898, and biennially thereafter, and at such other times as they, by resolution spread on their minutes, may appoint, and as often as they may be called together by their president on ten days' notice of the time of meeting. The president of the board of levee commissioners shall preside at all their meetings, sign the minutes of their proceedings, and do all other acts and things which he may be authorized and empowered to do by said board; and he shall hold his office for such time as said board may appoint, and may be removed from office at their discretion; and in case he shall be absent at any meeting of the said board, a president pro tem. shall be elected; and in the event there should be a vacancy in the office of president said board shall elect another member of said board as president. The secretary and treasurer shall keep a record of the proceedings of the board of levee commissioners and receive all moneys directed to be paid to him by law, and pay out the same on the order of the president of said board, and do all other acts and things which may be required of him; and he shall execute a bond, with two or more sureties, to be approved by said board, at such time and in such penalty as said board may determine, payable to the president of said board and his successors in office, conditioned for the faithful performance of his duties; and on forfeiture said bond may be put in suit and prosecuted in the name of the president or of said board for any breach of the same; and he shall hold his office for such time as said board may prescribe, and may be removed from office at any time by said board, who shall elect his successor; and in case of vacancy in the office, from removal or other cause, it shall be filled by election in like manner; and his salary shall be fixed by said board, and when so fixed the money for its payment shall be drawn upon the order of the president of said board.

SEC. 4. That said board of levee commissioners shall have power, and it is hereby made their duty, to rebuild, strengthen, and elevate the old levees, or make new embankments of levees, in the territory under their charge, which levees shall be constructed along the waters bounding said district as first above set out, or such other places as said board may determine; to care for and properly protect the same after they shall have been built, and to provide means for draining off water ponded by said levees; and they shall have power to employ all engineers and agents necessary for the work, and they shall determine the base, height, and slope of the levees, and may abandon any portion of old levees that they may regard as improperly built or unsafe, and may build new and repair old levees on such ground as they may select, and make all needful regulations and do acts necessary in their opinion to secure the lands within their jurisdiction from overflow by the waters of the Mississippi and Yazoo rivers.

SEC. 5. That said board of levee commissioners may either act as levee inspectors or may appoint suitable persons to act as such, and it shall be the duty of said levee inspectors to make annual reports of the condition of the levees, to avail themselves of the use of county convicts or road hands on levee construction work if permissible by law, to forbid all persons from using the levees as public roads by traveling on or near same in vehicles or riding on or near same, to post notices, at intervals of not more than two miles, warning all owners of horses, mules, and cattle to keep the same off the levees, when in their judgment it shall be deemed necessary for the safety of said levees, and to do all other acts and things that may be required of them by an order of said board of levee commissioners.

SEC. 6. That if any person shall ride or drive on or near the levees of the Yazoo-Chickasaw levee district, or shall allow horses, mules, or cattle to run on same after notices shall have been posted by an order of the board of levee commissioners for said district, he shall be liable for a fine of ten dollars, to be recovered before any court of competent jurisdiction, and paid into the treasury of said board; and if any person shall willfully cut, injure, or destroy said levee of said district, or procure the same to be done, the person so offending shall be guilty of a felony, and on conviction thereof shall be punished by imprisonment in the penitentiary of this State for a term not less than three years nor more than ten years.

SEC. 7. That it shall be unlawful for hogs to run at large upon the levees of said levee district, and it shall be the duty of the levee inspectors to shoot and kill any hogs found running at large thereon.

SEC. 8. That the board of levee commissioners for the Yazoo-Chickasaw levee district be, and is hereby, authorized to treat, contract, and negotiate with any agency of the United States Government in regard to and for the purpose of securing the construction, maintenance, and repair of the levees in said district, or the aid or cooperation of said agency in regard to said levees, and may make any and all arrangements with said agency as will in its judgment forward and assist in the purpose of securing from overflow the district confided to its charge. The said levee commissioners may also in their discretion contract and agree with any person or persons, corporation or corporations, for the construction, maintenance, or repair of the whole or any part of its line of levees, and such contracts may be made for such time and under such conditions, penalties, and forfeitures, and with such obligations, as said board may deem necessary to secure the faithful performance of the same and most conducive to the interests of its district.

SEC. 9. That for the purpose of paying any indebtedness or liability legally contracted by said board, an ad valorem tax of ten (10) mills on the dollar, or so much thereof as may be fixed by said board of levee commisioners at a meeting to be held annually during the month of September, upon the assessed value of all real property within said levee district, is hereby levied and assessed for each and every year: *Provided*, That no tax shall be collected on land lying on the outermost side of the levees of said levee district. The assessment for said ad valorem tax shall be made by the assessor of Warren County, State of Mississippi, at the same time and in the same manner as for the State tax, and shall be shown on the land roll separated into a subdivision of its own; and the said levee tax shall be a lien upon the property from the same time and to the same extent and in the same manner as State taxes, and the same shall be collected by the sheriff and tax collector of said Warren County at the same time and in the same manner and under the same laws that he may collect the State tax, and turn over the same when collected to the treasurer of said Yazoo-Chickasaw levee board, and the tax collector shall receive the same compensation for collecting said tax as he receives for collecting the State tax; and said collector shall execute bond to said levee board in the sum of $500.00, conditioned for the faithful performance of his duties.

SEC. 10. That said board of levee commissioners be, and is hereby, authorized and empowered to enter upon, take, and hold any land or premises whatever, whether by purchase, grant, or donation, devise, or otherwise, that may be necessary and proper for the location, construction, and maintenance of the line of the levees provided for in this act; and said board shall have the right to cut and remove trees, timber, and other material that might, by falling or otherwise, encumber or endanger said levees or any part thereof, and in case the owners of such land or premises can not agree with said board of levee commissioners as to the value of the premises taken or to be taken for the use of said board for the purpose of locating, constructing, or maintaining its line of levees therein, the value thereof shall be determined by the appointment of three disinterested commissioners, who shall be freeholders, and who shall, upon application in writing of either party, be appointed by the clerk of the chancery court of the county of Warren, State of Mississippi; and said clerk shall forthwith issue an order to the sheriff of said county, commanding him instantly to summon said commissioners to go upon and view the premises and inquire into the damages sustained and the compensation such landowner or other person interested is entitled to receive; and the commissioners summoned shall have five days' notice of the time and place of meeting, and shall be sworn by the sheriff justly and truly to try the value of the property and the damage sustained by the owner of said land or other person interested; and the said commissioners shall render their verdict and inquisition in writing, which shall be returned by the sheriff to the clerk who issued the writ. Upon return to said clerk of such appraisement, and upon the payment into his hands of the estimated value of the said premises and the damages assessed for the use and benefit of the owners thereof, said premises shall be ordered to be taken by said board of levee commissioners, which shall thereupon acquire full title to the same for the purposes aforesaid. Either party feeling aggrieved at such appraisement may, within thirty days after the same has been returned to said clerk, file an appeal therefrom to the next term of the circuit court of said county, and such appeal shall be tried in the same manner as appeals from justices' courts; but such appeals shall not interfere with the right of said board to enter upon the premises taken, or to do any act necessary or proper in the location and construction of its line of levees, and the party appealing shall give bond with sufficient surety for the payment of costs that may arise from such appeal: *Provided*, No damage shall be paid for land or buildings because of its being left outside of said levee.

Sec. 11. That said board of levee commissioners be, and is hereby, authorized and empowered to issue certificates of indebtedness to the amount of five thousand dollars ($5,000.00): *Provided*, That issue in excess of five hundred dollars ($500.00) shall first be voted for by a majority of the landowners in said levee district at an election held at the domicile of said board after thirty days' notice shall have been given therefor by publication on three successive days in a daily paper published in the city of Vicksburg, Mississippi.

Sec. 12. That this act take effect and be in force from and after its passage.

Approved February 2, 1898.

W 10.

IMPROVEMENT OF TALLAHATCHIE RIVER, MISSISSIPPI.

The small amount available for this improvement did not permit of much work during the year.

After reaching the head of Yazoo River the U. S. snag boat *John R. Meigs*, P. R. Starr, master, was employed in this stream January 13–17, 1898, removing tree slides, etc. Operations were carried from the mouth up to Philipp, Miss. The new bridge of the Yazoo and Mississippi Valley Railroad Company, across the river at Philipp, was not completed sufficiently to permit the *Meigs* to pass above, and it returned to Yazoo River and thence to Vicksburg, where it was laid up January 22.

The following work was done by the *Meigs* January 13–17, viz:

Snags pulled	29
Stumps pulled	2
Logs removed from channel	65
Side jams removed	2

New obstructions are brought into the river every year by drift and sliding and caving banks, and the shifting and scouring of the channel exposes snags and logs embedded in the bottom from time to time, or lodges them upon bars. An appropriation sufficient to permit the systematic clearing of the banks, in addition to snagging operations, could be expended profitably in one season of low water, would result in lasting benefit to navigation, and but small amounts would be needed for maintenance.

Money statement.

July 1, 1897, balance unexpended	$524.64
June 30, 1898, amount expended during fiscal year	524.64
Amount that can be profitably expended in fiscal year ending June 30, 1900	10,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

The following appropriations have been made:

By act of—	
March 3, 1879	$6,000
June 14, 1880	9,000
March 3, 1881	3,000
August 2, 1882	3,000
July 5, 1884	3,000
August 5, 1886	3,500
August 11, 1888	5,000

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	4,000
June 3, 1896	4,000
Total	50,500

COMMERCIAL STATISTICS.

The river was reported navigable to Sharkey the entire fiscal year.

List of stern-wheel steamboats navigating Tallahatchie River in fiscal year 1898.

Name.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
					Light.		Loaded.				
		Feet.	Feet.	Feet.	Ft.	In.	Ft.	In.			
Yazonia *a*	62.84	95.0	19.8	3.5	1	3	3	6	Greenwood and Sharkey	104	....
E. A. Pharr	95,11	90	29.9	4.5	1	10	3	5	Greenwood, Sharkey, and Coldwater River to Yazoo Pass.	104	200
Ferd. R. *a*	45.58	93.8	16.2	3	2	0	3	0	....do	104	75
Electric *a*	34.57	77.6	20	2.8	......		......		Greenwood and Sharkey	1	....
Memphis	220.25	111	26	4	2	6	5	0	Vicksburg and Tallahatchie River.	1	....
Rees Pritchard	196.2	150.3	31	3.3	1	2	3	8	....do	9	....
Novelty *a*	83.65	76.4	16.4	3	1	6	3	6	Vicksburg and Sharkey	1	....

a With one or more barges.

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.	1892–93.	1891–92.	1890–91.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	2,375	2,500	2,840	3,033	4,338	3,141	5,588	4,000
Cotton seed	9,362	7,170	6,374	6,940	7,300	4,400	8,257	6,000
Hides and skins	3	5	4	2	3	3	53	5
Live stock	29	52	45	46	30	30	31	32
Lumber	470	910	1,402	1,614	1,400	1,300	1,188	1,424
Staves	11,408	3,766	22,217	23,404	14,346	3,447	3,204	9,245
Provisions	106	4,206	4,200	4,800	4,700	3,450	5,571	4,200
Grain	240	200	200	6,300	6,100	1,800	5,725	4,800
Saw logs	10,000	2,000	4,600	20,000	49,500	26,700	24,473	19,000
Miscellaneous	177	1,625	1,690	4,800	5,100	4,100	6,329	5,000
Total	34,170	22,434	43,572	70,939	92,817	48,371	60,419	53,706
Estimated value	$735,000	$964,000	$1,167,000	$2,061,000	$2,372,000	$908,000	$2,428,000	$2,115,000

The Yazoo and Mississippi Valley Railroad, operated by the Illinois Central Company, has a branch line from Clarksdale to and across Tallahatchie River at Philipp, which is paralleled by a branch of the Southern Railway from Webb to Ittabena, and the Southern Railway and Illinois Central at Greenwood are competitors for the trade of Tallahatchie River. The Yazoo and Mississippi Valley Railroad is extending the Tallahatchie branch from Philipp to Greenwood, where it will connect with the Yazoo branch of the Illinois Central Railroad.

W II.

IMPROVEMENT OF BIG SUNFLOWER RIVER, MISSISSIPPI.

Work in this tributary of Yazoo River was continued during the fiscal year as follows:

A quarter boat for use in this stream and the Yazoo was commenced at Yazoo City July 26 and completed August 28, 1897. By courtesy of the officers of the Yazoo and Tallahatchie Transportation Company, the steamer *Hibernia*, belonging to that line, towed the boat to mouth of Big Sunflower River without charge.

Operations commenced at the mouth of the river August 30, were carried upstream about 80 miles to John Baird's place, and were suspended December 20, 1897, by continued rains and rising water. The work was in local charge of Overseer John Schuh, and was performed by a party of laborers equipped with axes, saws, tackle, explosives, etc. The stages were low and effective work was done. The outbreak of yellow fever at various places in the State, some of them close by, soon after operations commenced, and the strict local quarantines that followed rendered it difficult to deliver subsistence stores, explosives, etc., as required, and impracticable to increase the force.

The obstructions in the channel were sand bars, snags, logs, stumps, and trees, the latter having been brought into the river during the overflow from the Mississippi in the spring of 1897. At places leaning timber and brush along the banks also obstructed passage of steamboats. At the bars inexpensive brush dams were built and repaired, to contract the channel and create scour; snags, logs, stumps, and trees in the channel were removed or destroyed; the leaning timber was felled, topped, or girdled, as conditions rendered necessary, and the brush along shore well cleared, especial attention having been given to points and bends.

On Oliphant Bar the depth varied from 30 to 36 inches. Twelve wing dams were constructed and gave an immediate increase of 10 to 12 inches, with least depth of 40 inches. The left chute at head of Maybin Island was closed by a brush dam to force the water into the channel used at low water. A side jam was removed from a short bend at Campbellsville, and 3 jams and 7 side jams were destroyed in the stretch called "The Hurricane." Two wing dams were built at Choctaw Bar, a small island was cleared of all timber and brush, and a chute closed to force all the water down the main channel, which soon scoured from 36 to 48 inches in depth. At Muscle Shoals the wing dams were repaired, all obstructions removed from the channel, and the top crust of blue clay and shells was loosened with explosives, increasing the depth about 13 inches in a short time. At Ratliff Place, 1 mile above "Head of Drift," a bar had formed during the last overflow. At this place snags, logs, stumps, and trees were numerous, covered with sand, and 36 inches was the greatest depth; but after two days' work in destroying these obstructions there was 50 inches depth of channel. A wing dam was built at Callao and 5 at the Hedrick or Warren Place, all with good results, increasing the depth 8 to 12 inches. At Hunt Place a side jam caused by three caved-in trees was destroyed. The average depth found upon the bar at Hollywood was 14 inches, but after removing all obstructions, building 6 wing dams, and using explosives the depth increased to 26 inches in forty-eight hours. At the lower end of Brady Place a mud bar caused by a landslide, about 55 square yards in area, covered with a growth of willows, was removed with explosives. Three wing dams were constructed at Shellridge and 1 at Woodburn. At the time these were built heavy frosts had stripped the foliage from the trees and brush, and naked boughs could not be used effectually. These dams, therefore, were constructed of lumber and heavy logs and tree trunks taken from the bottom of the river. Two large trees, embedded in the bottom and lying across the channel, formed a bar at Woodburn and were destroyed.

The following is a summary of the work done August 30 to December 20, 1897, viz:

Distance worked over .... miles..	80
Channel snags pulled, cut, and destroyed	6,476
Stumps pulled, cut, and destroyed	3,887
Shore snags cut and destroyed	4,173
Logs pulled, cut, and destroyed	7,167
Leaning trees cut and destroyed	17,852
Leaning trees topped	559
Trees girdled	21,948
Square yards willows and brush cut	3,305
Jams removed	3
Side jams removed	11
Linear feet of wing dams built	2,817

(Thirty-two dams were built, containing 614 square yards of brush, 33 cords of poles and stakes, and 2,000 feet of lumber.)

So far as it extended, this work put the river in good navigable condition and, after the quarantine was raised, the small steamboats used in this river at low stages followed the party as operations progressed upstream. Above the point where work stopped, however, the river is much obstructed and should receive prompt attention in the interest of safe navigation.

After suspension of operations the quarter boat was dropped back to mouth of the river, whence the U. S. snag boat *Meigs* towed it to Yazoo City to undergo repairs and be ready for use in Yazoo River.

Attention is invited to the following extract from my report of 1891, repeated each year since, viz:

> The estimate of $66,000, made in 1879, for the improvement of this river (p. 984, Report Chief of Engineers, 1879) did not contemplate doing the work at irregular intervals extending over a period of fifteen years, as it will with the usual appropriations, but was made with a view to finishing it in not more than three or four consecutive seasons. As new obstructions are added from time to time it is impossible to make any definite estimate, but if an appropriation of not less than $20,000 is made it can be spent to advantage and with economy in one or two low-water seasons and result in greater benefit to navigation and work of a more lasting character than a larger sum by small allotments every other year.

Money statement.

July 1, 1897, balance unexpended	$5,000.00
June 30, 1898, amount expended during fiscal year	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	20,000.00

The appropriations have been as follows:

By act of—	
March 3, 1879	$20,000
June 14, 1880	8,000
March 3, 1881	4,000
August 2, 1882	5,000
July 5, 1884	5,000
August 5, 1886	5,000
August 11, 1888	5,000

By act of—	
September 19, 1890	$5,000
July 13, 1892	5,000
August 18, 1894	5,000
June 3, 1896	5,000
Total	72,000

COMMERCIAL STATISTICS.

Lower Big Sunflower River was reported navigable for nine months of the fiscal year, or with exception of the period September 1 to November 29.

List of stern-wheel steamboats engaged in navigation during the year.

Name.	Tonnage.	Length.	Breadth.	Depth.	Draft.				Between—	Round trips.	Passengers.
					Light.		Loaded.				
		Feet.	Feet.	Feet.	Ft.	In.	Ft.	In.			
Rescue	135.4	126	24.3	3.7	1	10	3	0	Yazoo City and Campbellsville	50	200
Maggie	50.73	85	19	3.5	1	6	3	0	do	10	25
Fifteen	75	103	18	3.5	2	0	3	6	do	2	5
Atlanta *a*	85.03	93	16.4	3.7	2	2	3	0	Vicksburg and Woodburn	3	....
									Vicksburg and Lehrton	1	....
									Vicksburg and Dr. Balmer's	1	....
									Vicksburg and Silver Creek	1	....
Novelty *a*	83.65	76.4	16.4	3	1	6	3	6	Vicksburg and Callao	3	....
									Vicksburg and Woodburn	12	125
									Vicksburg and Lehrton	2	....
Josephine Loviza *b*	93.25	113.6	22.2	3.7	2	4	3	6	Vicksburg and various landings	4	....
Mary Joyce *a*	54.2	65	14	2.4	1	1	2	0	Vicksburg and Woodburn	8	....
Lake Palmyra *a*	141.16	123.5	26	4.8	3	0	4	6	do	6	11
Water Maiden *a*	28.59	69	12	2.6	1	11	2	0	do	2	....
Hibernia *a*	157.06	135	25	4	2	0	4	0	do	2	....
Mildred *a*	19.76	54.5	11	3.2	......		......		do	2	....
Mima *a*	62.72	66	27	3.2	1	2	2	6	do	3	....
Ruth	319.4	160	31.5	5	3	0	6	6	do	1	....
C. H. Woods	70.83	110	22	3.2	1	8	1	8	(Sawmill boat)	....	....
Resolute *b*	207.78	139.6	29	3.9	3	0	4	3	No report received	....	....
Alarm *b*	189.09	142	26	4.3	......		......		do	....	....

a With one or more barges. *b* Towboats.

Summary of commerce reported.

Articles.	1897–98.	1896–97.	1895–96.	1894–95.	1893–94.	1892–93.	1891–92.	1890–91.	1889–90.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Cotton	1,174	2,250	2,050	3,601	2,400	2,699	4,118	2,375	2,594
Cotton seed	2,579	5,132	5,407	5,760	5,700	5,250	5,450	3,500	3,975
Hides	....	14	17	24	12	19	12	....	....
Live stock	22	524	80	71	38	250	265	70	150
Saw logs	....	4,000	1,200	2,475	5,650	19,000	21,835	15,400	4,000
Lumber	....	564	557	1,500	780	1,130	906	920	869
Staves	2,675	9,700	17,805	8,105	9,405	9,840	4,430	3,219	5,250
Miscellaneous	750	9,700	9,372	375	2,050	1,088	2,549	2,027	....
Total down freight	7,200	31,884	36,488	21,911	26,035	39,276	39,565	27,511	16,838
Return freight	1,731	3,228	2,380	2,623	4,285	4,023	7,489	4,473	5,322
Total	8,931	35,112	38,868	24,534	30,320	43,299	47,054	31,984	22,160
Estimated value	$251,000	$702,000	$783,000	$956,000	$988,000	$893,000	$1,354,000	$945,000	$1,240,000

The Yazoo and Mississippi Valley Railroad crosses the river at Clarksdale and thence runs south parallel to the stream at distances varying from 5 to 20 miles. The Georgia Pacific (Sixth) Division of the Southern Railway crosses the river at Baird with a line running from Greenville, on the Mississippi River, to Atlanta, Ga.

It is understood that the Yazoo and Mississippi Valley Railroad Company has purchased a lumber railroad from Ruleville to Moorhead, 20 miles long, along the east side of Big Sunflower River, and contemplates extending it to the Tallahatchie branch.

W 12.

WATER GAUGES ON THE MISSISSIPPI RIVER AND ITS PRINCIPAL TRIBUTARIES.

The present service consists of twenty-two gauges, at which observations at 8 a. m. and 4 p. m. daily were continued during the fiscal year ending June 30, 1898, viz: On Mississippi River, at St. Louis, Mo., Cairo, Ill., Memphis, Tenn., Helena, Ark., mouth of White River, Arkansas, Lake Providence, La., Vicksburg, Miss., Natchez, Miss., Red River Landing, La., Baton Rouge, La., Donaldsonville, La., and Carrollton (New Orleans) La.; on Ohio River, at Louisville, Ky., head and foot of falls; on Tennessee River, at Florence, Ala.; on Cumberland River, at Nashville, Tenn.; on White River, at Jacksonport, Ark.; on Arkansas River, at Little Rock, Ark., and on Red River, at Alexandria and Shreveport, La., and Garland and Fulton, Ark.

Records of the daily readings were furnished the secretary of the Mississippi River Commission; copy of the Florence record was furnished the engineer officer in charge of Tennessee River; copy of the Carrollton record was sent the assistant engineer at South Pass of the Mississippi; copy of the Jacksonport record was sent the chief engineer of the Mississippi Levee Commissioners, and district officers, levee commissioners, etc., were furnished copies of records upon application.

The following gauges were inspected during the year by Asst. Engineer John Ewens, viz:

Date.	Gauge stations.	Repairs made, etc.
1897.		
Sept. 6	St. Louis, Mo	No repairs needed.
10	Louisville, Ky. (upper)	Do.
10	Louisville, Ky. (lower)	Do.
13	Nashville, Tenn	Deposits of dirt removed from 39 to 46 foot mark of inclined section.
14	Florence, Ala	Vertical gauge on Memphis and Charleston Railroad Bridge rebuilt in 1 section from —2 to 35 feet.
16	Memphis, Tenn	Vertical gauge at foot of Beale street rebuilt from —3 to 39 feet, in 9 sections, viz: —3 to 4, 3 to 8.4, 8 to 12.2, 10 to 14, 13 to 20, 19.5 to 25, 23.6 to 33.4, 32 to 36.4, and 34 to 39.
Oct. 14	Little Rock, Ark	Vertical gauge on Baring Cross Bridge rebuilt from —2 to 32.5 feet, in 1 section. Bulletin reset and brush and small trees cleared from in front of it.
15	Jacksonport, Ark	Vertical gauge rebuilt from —2 to 26.5 feet, in 5 sections, viz: —2 to 4, 2 to 9, 8 to 13, 13 to 18.9, and 18 to 26.5.
19	Fulton, Ark	No repairs needed.
20	Garland, Ark	No repairs needed beyond removal of mud deposits.
22	Shreveport, La	No repairs needed.
25	Cairo, Ill	Vertical portion of gauge, from 51 to 54 feet, rebuilt in 2 sections, viz: 51 to 54 and 47 to 54. Inclined gauge cleaned where deposit had formed.
28	Helena, Ark	Vertical gauge rebuilt from —4 to 53.3 feet, in 7 sections, viz: —4 to 1.3, —1 to 9, 9 to 24, 23 to 31, 26 to 38.4, 38 to 45, and 42.9 to 53.3. New bulletin needed
Nov. 5	Mouth White River, Arkansas.	Vertical gauge rebuilt from —4 to 55 feet, in 9 sections, viz: —4 to 6, 5 to 11, 11 to 17, 16 to 20, 20 to 25, 25 to 30, 30 to 37.4, 37 to 45, and 44 to 55. New bulletin needed.

Date.	Gauge stations.	Repairs made, etc.
1897. Nov. 11	Lake Providence, La	Vertical gauge rebuilt from —4 to 47 feet, in 9 sections, viz: —4 to 1, —3.5 to 3.1, 3 to 8, 7.5 to 12.2, 12 to 18.2, 18 to 25, 25 to 33, 32 to 42, and 36 to 47. New bulletin needed.
15	Vicksburg, Miss	Vertical gauge at Kleinston Landing rebuilt from —7 to 54 feet, in 4 sections, viz: —7 to 12, 12 to 26, 25 to 40, and 40 to 54.
25	Natchez, Miss	Vertical gauge rebuilt from 0 to 52 feet, in 3 sections, viz: 0 to 8, 0 to 6, and 5 to 52. New bulletin needed.
27	Red River Landing, La	Vertical gauge rebuilt from —2 to 52 feet, in 8 sections, viz: —2 to 5.4, 0 to 7, 3 to 11, 11 to 18, 18 to 27, 27 to 36, 36 to 43.2, and 42 to 52.
30	Baton Rouge, La	Vertical gauge rebuilt from —1 to 43 feet, in 8 sections, viz: —1 to 6, 5 to 11.4, 11 to 17.4, 17 to 24, 24 to 30 2, 30 to 37, 23 to 41, and 36 to 43.
Dec. 11	Alexandria, La	Vertical gauge rebuilt from —4 to 39.2 feet, in 8 sections, viz: —4 to 0, —1 to 5, 2 to 10, 9 to 16, 17 to 22, 21 to 27.5, 26 to 33, and 31 to 39.2.
13	Donaldsonville, La	No repairs made.
15	Carrollton, La	Vertical gauge rebuilt from —2 to 22 feet, in 5 sections, viz: —2 to 3, 1 to 6, 6 to 12, 11 to 17.2, and 12 to 22.
1898. Jan. 27	Vicksburg, Miss	No repairs made.
Feb. 15	Memphis, Tenn	Beale street gauge rebuilt from 20 to 36.5 feet, in 4 sections, viz: 20 to 26.6, 23.6 to 30.5, 29 to 32.5, and 32 to 36.5.

Itemized statement of expenditures during the fiscal year ending June 30, 1898, submitted in compliance with requirements of section 6 of river and harbor act of 1888.

Observations:		
Pay of 21 permanent gauge keepers from July 1, 1897, to June 30, 1898, inclusive		$3,720.00
Inspections and repairs:		
Pay of assistant engineer, 6 months and 6 days, at $175 per month	$1,085.00	
Traveling expenses of assistant engineer while inspecting gauges	275.00	
Pay of employees hired to assist gauge inspector and to repair gauges and bulletins	37.00	
Material for repair of gauges	170.70	
Drayage of material for repair of gauges	1.00	
Material for packing and shipping gauge staves	.80	
Charcoal for heating brands for marking gauges	1.00	
One handsaw	1.50	
		1,572.00
Office expenses and contingencies:		
Pay of clerk, 1 month and 18 days, at $100 per month	160.00	
Stationery	45.21	
Telegrams	.90	
Telephone hire	.28	
		206.39
		5,498.39
Outstanding liabilities June 30, 1898:		
Land-grant accounts of Missouri Pacific Railway Company for transportation of gauge material in July and September, 1897. (Vouchers forwarded to Chief of Engineers for settlement by accounting officers of the Treasury September 7 and December 20, 1897.)		1.61
Total for fiscal year ending June 30, 1898		5,500.00

Money statement.

July 1, 1897, amount allotted for fiscal year ending June 30, 1898	$5,500.00
June 30, 1898, amount expended during fiscal year	5,498.39
July 1, 1898, balance unexpended	1.61
July 1, 1898, outstanding liabilities	1.61
July 1, 1898, amount allotted for fiscal year ending June 30, 1899	6,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	9,600.00

The laws relating to the water gauges on the Lower Mississippi and its tributaries are as follows: Their establishment and maintenance were directed by joint resolution of Congress, approved February 21, 1871 (sec. 5252, Rev. Stats.), viz:

> SEC. 5252. The Secretary of War is hereby authorized and directed to have water gauges established and daily observations made of the rise and fall of the Lower Mississippi River and its chief tributaries at or in the vicinity of St. Louis, Cairo, Memphis, Helena, Napoleon, Providence, Vicksburg, Red River Landing, Baton Rouge, and Carrollton, on the Mississippi, between the mouth of the Missouri and the Gulf of Mexico; and at or in the vicinity of Fort Leavenworth, on the Missouri; Rock Island, on the Upper Mississippi; Louisville, on the Ohio; Florence, on the Tennessee; Jacksonport, on the White River; Little Rock, on the Arkansas, and Alexandria, on the Red River, and at such other places as the Secretary of War may deem advisable. The expenditure for the same shall be made from the appropriation for the improvement of rivers and harbors, but the annual cost of the observations shall not exceed the sum of five thousand dollars.

The river and harbor act of August 11, 1888, provided a permanent indefinite appropriation for the purpose of securing uninterrupted gauging, as follows:

> SEC. 6. That for the purpose of securing the uninterrupted gauging of the waters of the Lower Mississippi River and its tributaries, as provided for in joint resolution of the twenty-first of February, eighteen hundred and seventy-one, upon the application of the Chief of Engineers, the Secretary of War is hereby authorized to draw his warrant or requisition from time to time upon the Secretary of the Treasury for such sums as may be necessary to do such work, not to exceed in the aggregate for each year the amount appropriated in this act for such purpose: *Provided, however,* That an itemized statement of said expenses shall accompany the Annual Report of the Chief of Engineers.

The amount appropriated in the act of August 11, 1888, was—

> For gauging the waters of the Lower Mississippi River and its tributaries, as provided for in joint resolution of twenty-first of February, eighteen hundred and seventy-one, nine thousand six hundred dollars: *Provided,* That three thousand six hundred dollars of same is authorized to be expended in paying the expenses of gauging the said waters during the fiscal year ending June thirtieth, eighteen hundred and eighty-eight.

The same act, in the item of appropriation for continuing operations upon the reservoirs at the head waters of the Mississippi River, provided as follows:

> And the Secretary of War shall cause such gaugings to be made at or near St. Paul during the annual operation of said reservoirs as shall determine accurately the discharge at that point, the cost of same to be paid out of the annual appropriation for gauging the waters of the Mississippi River and its tributaries.

The appropriations and allotments for this work have been as follows:

Allotments from general appropriations for examinations, surveys, and contingencies of rivers and harbors by acts of—	
March 3, 1871	$5,000
June 10, 1872	5,000
March 3, 1873	5,000
June 23, 1874	5,000
March 3, 1875	5,000
Specific appropriations by river and harbor acts of—	
August 14, 1876	5,000
June 18, 1878	5,000
March 3, 1879	5,000
June 14, 1880	5,000
March 3, 1881	5,000
August 2, 1882	5,000
Deficiency act of March 12, 1884	2,100
Specific appropriations by river and harbor acts of—	
July 5, 1884	5,000
August 5, 1886	5,000
Allotted from specific appropriation by river and harbor act of August 11, 1888	8,700

Deficiency act of October 19, 1888	$3,600
Allotments from permanent appropriation made by section 6 of river and harbor act of August 11, 1888, for fiscal years, viz:	
1890	9,000
1891	8,700
1892	5,100
1893	5,500
1894	5,500
1895	5,500
1896	5,500
1897	5,500
1898	5,500
Total	135,200

The following statement shows the disposition of the funds apportioned to this work:

Amount expended to June 30, 1897	$125,087.88
Amount of deficiency appropriation of October 19, 1888, not used	3,600.00
Balance of appropriation by act of August 11, 1888, not expended	1,566.29
Balance of allotment for fiscal year 1890, not expended	1,281.66
Portion of allotment for fiscal year 1891 withheld at United States Treasury under ruling that only $6,000 can be drawn each fiscal year	3,518.34
Balance of allotment for fiscal year 1896 not expended	145.83
Total, as above	135,200.00

Comparison of highest water of fiscal year 1898 with highest previously recorded since establishment of present gauges.

Gauge stations.	Year gauge was established.	Elevation of gauge zero above Cairo datum plane.	Elevation of gauge zero above mean Gulf level at Biloxi, Miss.[a]	Highest water previously recorded on present gauge.		Highest water during fiscal year ending June 30, 1898.		Relation to previous highest record.
				Date.	Gauge reading.	Date.	Gauge reading.	Below.
		Feet.	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Louis, Mo	1871	400.23	378.97	May 19, 1892	35.95	May 23	27.20	8.75
Cairo, Ill.	1871	290.84	269.58	Feb. 27, 1883	52.17	Apr. 6	49.78	2.39
Memphis, Tenn.	1871	203.97	182.71	Mar. 20, 1897	37.68	Apr. 10[c]	37.22	.46
Helena, Ark.	1871	161.98	140.72	Apr. 4, 1897	51.75	Apr. 17	49.10	2.65
Mouth White River, Ark.	1871	128.73	107.47	Mar. 29, 1897	52.42	Apr. 19	51.05	1.37
Lake Providence, La.	1871	89.62	68.36	Mar. 30, 1897	44.54	Apr. 23	44.35	.09
Vicksburg, Miss.	1871	66.04	44.78	Apr. 16, 1897	52.45	Apr. 23–35	49.40	3.05
Natchez, Miss.	1871	36.89	15.63	May 1, 2, 6, 1897	49.83	Apr. 26, 27	47.40	2.43
Red River Landing, La.	1871	23.85	2.59	May 14, 15, 1897	50.20	Apr. 28–30	44.30	5.90
Baton Rouge, La.	1871	20.06	— 1.20	May 13–15, 1897	40.65	Apr. 29–May 1.	34.60	6.05
Donaldsonville, La.	1890	[b]19.14	—[b]2.12	May 13, 1897	32.75	Apr. 30	28	4.75
Carrollton, La.	1872	20.91	— .35	do	19.17	Apr. 25	15.90	3.27
Louisville, Ky. (upper).	1871	[b]419.76	[b]398.50	Feb. 16, 1884	46.60	Mar. 30	36.20	10.40
Louisville, Ky. (lower).	1871	[b]392.85	[b]371.59	do	72	do	62	10
Florence, Ala.	1871	[b]418.03	[b]396.77	Mar. 19, 1897	32.50	Jan. 20, 27–29	13.80	18.70
Nashville, Tenn.	1873			Jan. 22, 1882	55.30	Jan. 23	38.80	16.50
Jacksonport, Ark.	1871			Mar. 14, 1890	33.35	Mar. 30	32.50	.85
Little Rock, Ark.	1871	241.50	220.24	May 21, 1892	31.20	May 11	29.30	1.90
Alexandria, La.	1871	64.46	43.20	June 12, 13, 1892	38.25	Jan. 23	17.40	20.85
Shreveport, La.	1890	161.27	140.01	May 28, 1892	35.70	May 21	15	20.70
Garland, Ark.	1890	223.44	202.18	Mar. 24, 1894	28.50	May 11	27.70	.80
Fulton, Ark.	1890	244.78	223.52	May 23, 24, 1892	34.85	do	27.90	6.95

[a] Mississippi River Commission preliminary value, 21.26 feet above Cairo datum plane.

[b] Preliminary value.

[c] Reading of Memphis gauge at elevator April 10, 1898, reported to be 37.50 feet.

NOTE.—In my last report the following readings of highest water of 1897 were given, viz: Lake Providence, 44.40; Donaldsonville, 32.85, and Carrollton, 19.10. The slight corrections which have been applied in the above table were derived from subsequent inspections of the gauges and levels to authentic high-water marks.

Comparison of lowest water of fiscal year 1898 with lowest previously recorded since establishment of present gauges.

Gauge stations.	Year gauge was established.	Lowest water previously recorded on present gauge.		Lowest water during fiscal year ending June 30, 1898.		Relation to previous lowest record.
		Date.	Gauge reading.	Date.	Gauge reading.	Above.
			Feet.		*Feet.*	*Feet.*
St. Louis, Mo	1871	Jan. 13, 1895	—0.80	Dec. 24	—0.40	0.40
Cairo, Ill	1871	Dec. 24, 1871	—1	Oct. 22–28	2.50	3.50
Memphis, Tenn	1871	Nov. 6–9, 1895	—2.65	Oct. 27–31	.25	2.90
Helena, Ark	1871	Nov. 8–9, 1895	—3	Oct. 30	— .70	2.30
Mouth White River, Ark.	1871	Dec. 28, 1872	0	do	2.81	2.81
Lake Providence, La.	1871	Nov. 17, 1895	—5.30	Nov. 2–6	—3.70	1.60
Vicksburg, Miss	1871	Nov. 13, 14, 1895	—6.53	Nov. 5–10	—3.50	3.03
Natchez, Miss	1871	Nov. 13–15, 1895	— .85	Nov. 6	3	3.85
Red River Landing, La.	1871	Nov. 14, 1895	— .60	Nov. 3, 4, 6	.45	1.05
Baton Rouge, La	1871	Nov. 14, 1894	.45	Oct. 26	1.40	.95
Donaldsonville, La	1890	Nov. 11, 1894	1	Nov. 27	1.95	.95
Carrollton, La	1872	Dec. 27, 1872	—1.60	do	.10	1.70
Louisville, Ky. (upper).	1871	Nov. 14–16, 1895 Sept. 10–14, 18–22, 1881.	1.70	Sept. 21–29	2.40	.70
Louisville, Ky. (lower).	1871	Oct. 17, 18, 1872	1.60	Oct. 1	2.40	.80
Florence, Ala	1871	Sept. 18, 1878	— .76	Oct. 11	— .50	.26
Nashville, Tenn	1873	Oct. 15, 16, 1878	— .40	Oct. 25, 26, 31	.06	.46
Jacksonport, Ark	1871	Dec. 24, 1872	—1.10	Oct. 6–10, 25–30	— .15	.95
Little Rock, Ark	1871	Oct. 23, 24, 1879	—1	Oct. 26–31, Nov. 14–16, Dec. 7–11.	2.50	3.50
Alexandria, La	1871	Sept. 29, 1881	—3.70	Nov. 25–28	—3.10	.60
Shreveport, La	1890	Dec. 2–4, 1894	—5.50	Nov. 27–Dec. 14	—2.00	3.50
Garland, Ark	1890	Sept. 22–25, 1896	— .20	Nov. 24, Dec. 7–9	.20	.40
Fulton, Ark	1890	Sept. 19–25, 1896 Oct. 20–22, 1896	.10	Nov. 23–25 Dec. 1–10	1	.90

APPENDIX X.

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

REPORT OF CAPT. WM. L. SIBERT, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1898, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

1. Removing obstructions in Arkansas River, Arkansas and Kansas.
2. Arkansas River, Arkansas.
3. White River, Arkansas.
4. Black River, Arkansas and Missouri.
5. Current River, Arkansas and Missouri.
6. St. Francis River, Arkansas.
7. St. Francis River, Missouri.

SURVEYS.

8. Arkansas River at Dardanelle, Ark.
9. St. Francis River, Arkansas, for slack-water navigation up to Wittsburg, and to Marianna, on L'Anguille River.

United States Engineer Office,
Little Rock, Ark., July 15, 1898.

General: I have the honor to forward herewith annual reports for the fiscal year 1898 of the following works of river and harbor improvement under my charge.

* * * * * * *

Very respectfully, your obedient servant,

Wm. L. Sibert,
Captain of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

X 1.

REMOVING OBSTRUCTIONS IN ARKANSAS RIVER, ARKANSAS AND KANSAS.

Operations this fiscal year.—The operations under this head were confined to the river below Pine Bluff, Ark. The U. S. snag boat *Beauregard* was at work in this part of the stream at the beginning of the year and worked over the entire reach whenever the stage of water was suitable. Work was suspended from September 7 to September 20, inclusive, on account of frequent outbreaks of sickness in the crew; from November 1 to December 26, inclusive, on account of shoal water at Medfords; from December 29 to January 9, inclusive, on account of shoal water at Victoria, and once for a few days on account of river being too high. The final suspension of work was on February 22, when the boat was laid up at Pine Bluff.

The operations of this year are shown in tabular form below:

Month.	Between—	Snags removed.	Trees cut.	Drifts removed.
1897.				
July	White River cut-off and Pine Bluff	385	413	7
August	Pine Bluff and Oxford Bend	395	688	8
September	Medfords and foot of White River cut-off	164	....	2
October	Foot of White River cut-off and Medfords	331	496	1
1898.				
January	Arkansas Post and foot of White River cut-off	....	3,044	....
February	Head of White River cut-off and St. Marys Bend	....	8,623	....
	Total	1,275	13,264	18

Remarks and recommendations.—The nature of the banks and bottom of the Arkansas River has been described in previous reports, but these descriptions do not show plainly the rapidity with which snags gather in this stream, more especially in the lower reaches where the current is deadened at times by the backwater from the Mississippi River. I went over the Arkansas River below Pine Bluff for the first time on the 28th and 31st of August, 1894. No snagging had been done in this portion of the river since September, 1891, and in many places it was necessary to lead the boat by lines through the snags, they being so numerous and in such positions that it was impossible to steer a boat through them. The improvements made by snagging in one season are nearly, if not entirely, lost during the high waters of the winter and spring following. Webbers Falls is 429 miles above the mouth of the river. One snag boat can not keep the channel to this place clear of snags and it is again recommended that a new boat be built to replace the *Wichita*, and that a new hull be built for the *Beauregard*, for the reasons stated in last Annual Report, page 1951. To procure a new boat and a new hull for the *Beauregard* it is estimated that $38,000 will be required.

Money statement.

July 1, 1897, balance unexpended	$18,072.59
June 30, 1898, amount expended during fiscal year	10,417.20
July 1, 1898, balance unexpended	7,655.39
Amount (estimated) required for work annually	35,000.00
Amount that can be profitably expended for maintenance in fiscal year ending June 30, 1900	35,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Appropriations for operating snag boats on the Arkansas River have been made intermittently since 1832. Many of the early appropriations were combined with those of other rivers without stated distribution of funds. The estimate of expenditures is not given as absolute, but as a close approximation.

July 3, 1832 (less $38 carried to surplus fund)	$14,962.00
March 3, 1835	40,000.00
March 3, 1837	25,000.00
July 7, 1838 (less $1,115.66 carried to surplus fund)	38,884.34
From appropriations 1842–1844 (estimate)	80,000.00
August 30, 1852 (less $269.47 carried to surplus fund)	39,730.53
From appropriations 1866–1878 (disbursements reported by Colonel Suter)	344,831.59
March 3, 1879 (part)	30,000.00
June 14, 1880 (part)	35,000.00
March 3, 1881 (part)	25,000.00
August 2, 1882	35,000.00

July 5, 1884	$36,000.00
August 5, 1886	19,875.00
August 11, 1888	25,000.00
September 19, 1890	20,000.00
July 13, 1892	20,000.00
August 18, 1894	20,000.00
June 3, 1896	20,000.00
Total appropriations	869,283.46
Expended to June 30, 1897	851,210.87
Unexpended July 1, 1897	18,072.59

COMMERCE.

The commerce of this stream is reported under the head "Improvement of Arkansas River, Arkansas."

X 2.

IMPROVEMENT OF ARKANSAS RIVER, ARKANSAS.

The work done in previous years is shown on pages 1852–1855 of Annual Report for 1896 and on pages 1953–1958 of Annual Report for 1897.

OPERATIONS THIS FISCAL YEAR.

General statement.—The snag boat *Wichita* worked a few days in July and a few days in September and October in the vicinity of Little Rock. The work of closing secondary channels below Pine Bluff was begun July 12, some brush and piles being cut for dam at Fergus Chute, but on account of a slight rise work was suspended. Work was resumed September 13 at Fergus Chute, 3 miles below Pine Bluff, and closed for the season at Pendleton, 66 miles below Pine Bluff, October 30. Eight secondary channels were closed and 3 wing dams built on wide crossings. In the 20 miles under improvement above Little Rock the work was confined to completing the revetments and dikes left unfinished at the end of last fiscal year and to closing a few low-water chutes in the vicinity of Newtons Bend and Little Maumelle Creek. Work was commenced September 6 and was suspended December 16. Survey of this portion of the river was made in August and September. In January this survey was extended upstream 7 miles, to Ross Hollow. Some additional work was done on Fletchers Bend Revetment in this month. Dike No. 2 and the revetment below Mallorys Ditch at Pine Bluff were repaired.

DETAILED STATEMENT OF WORK DONE THIS FISCAL YEAR.

SNAGGING OPERATIONS.

The snag boat *Wichita* was in commission at the beginning of the fiscal year, being at Cribbs Crossing. The boat worked from here downstream to the Keatts Place, 15 miles below Little Rock, by the 16th of July. The boat then returned to Little Rock and lay up. In September and October the boat spent ten days in Rectors Chute. Two hundred and fifteen snags were removed by these operations.

OPERATIONS FOR TEMPORARY IMPROVEMENT.

At many of the shoals, more especially below Little Rock, there are several channels, none of which have in them during low stages sufficient water for navigation purposes. These channels are very shifting, and as they lie in reaches of river in which works for permanent improvement have not been commenced authority was obtained to close all but one of the channels at the most troublesome shoals by low dams or spur dikes built of brush and sand bags.

The dams closing the secondary channels at the different shoals were similar in design and are briefly described thus: Piles or poles 4 to 8 inches in diameter at the larger end were driven in a line across the chute, the piles being spaced 6 to 8 feet apart; longitudinal stringers made of poles were then wired or nailed to the piles. The brush, in the form of fascines, was laid with the butts of the brush on the stringers and the tops upstream. The tops were weighted with sand bags. When the conditions were such as to make it inconvenient to wade and place the brush, a mattress was woven off of a barge, the downstream edge of the mattress being supported on the stringers. The working plant used consisted of 1 barge 20 by 60 by 3 feet, 4 barges 18 by 30 by 1.6 feet, 1 hand pile driver of same size as the small barges, and a living boat 12 by 35 by 1.5 feet, upon which 2 tents were placed for the use of the white persons in the working party. Colored labor was used, being paid at the rate of $1 per day and raw rations furnished them prior to October 17, after which time the wages were increased 25 cents per day. The party was in the field forty-three working days, nine of which were consumed in floating the plant down the river. Tabulation below shows the lengths, heights, and cost of the several dams built. The lengths given are the lengths across the water and do not include the portion of the structures that extend onto the bars to prevent the water cutting around the ends of the work. The height of the structures is referred to the water surface when they were built.

Detailed statement, works for temporary improvement.

Miles above mouth.	Place.	Nature of work.	Date.	Depth when work began.	Depth October 30.	Height of dam.	Length.	Sacks.		Brush.		Cost of labor.	Total.
								Number.	Value.	Cords.	Value.		
				In.	*In.*	*Ft.*	*Ft.*						
103.5	Fergus	Closing left chute.	Sept.13	16	16	5	484	1,700	$97.75	75	....	$367.29	$465.04
96.5	Robroy	do	Sept.23	18	18	3	500	1,200	69.00	50	$5.00	300.12	369.62
91	Madding	Wing dam from left bar.	Sept.14	15	16	3.5	500	2,550	146.62	65	....	364.45	427.07
72	Pleasant	2 wing dams from left bar.	Sept.30	20	21	3	300	1,600	92.00	25	....	371.92	463.92
72	do	Closing right chute.	Sept.30	20	21	3.5	200						
65.2	Lake Place	do	Oct. 7	23	27	3.5	150	1,200	69.00	40	....	254.95	323.95
55.5	Lower Samples	do	Oct. 15	20	21	4	150	800	46.00	20	....	154.27	200.27
52.5	Lower Reydel	Closing left chute.	Oct. 20	22	23	3	142	900	51.75	24	....	157.03	208.27
41.6	Pendleton	Closing first left chute.	Oct. 25	19	20	4.5	100	1,500	86.25	50	....	274.10	360.35
41.6	do	Closing second left chute.	Oct. 25	....	...	3	250						
	Total	....	....	....	...	....	2,876	11,450	658.37	349	....	2,244.13	2,818.49
	Property purchased												230.48
	Total (8 crossings, at $381.12 each)												3,048.97

$$\frac{\$3{,}048.97}{2{,}876} = \$1.06, \text{ cost of dams per linear foot.}$$

OPERATIONS FOR PERMANENT IMPROVEMENT.

Fletchers Bend.—This work consisted of completing the revetment between low water and 8-foot stage, October 28 to November 6, 1897, and of repairing some small breaks, January 10 to January 20, 1898. The stone was purchased delivered on the bank at Natural Steps and was towed to the work by the snag boat *Wichita.* Dike L, which was left in rough form at close of last fiscal year, was shaped during the progress of the above-mentioned work.

Reids Bend.—This work was incomplete between low water and 6-foot stage at close of last fiscal year. From September 6 to October 23, 1897, a party was employed in the completion of this work. In January, 1898, 63 cubic yards of stone were placed in a small break near the upper end of the revetment. The 63 cubic yards of stone used in January were obtained at Natural Steps, the remainder at Ives Point. All the stone was towed to the work by the snag boat *Wichita.*

Dikes at foot of Reids Bend.—The mattress and shore protection for Dikes M and N were built last fiscal year. The piles in Dike M were driven and the stringers placed September 6 to 15, 1897, but the screen was not placed. Nothing was done at Dikes N or O. The piling for the completion of Dike N was stored on the bank near by, but it was probably carried away or badly scattered by the spring flood.

Head of Rectors Island.—The only work here was repairing a small break in Dam I, using 66.3 cubic yards of stone, in January, 1898, the stone being obtained at Natural Steps.

Crystal Hill.—The training wall to Dike F was not completed at the close of last fiscal year. The stone was purchased delivered in the work, and delivery was completed July 2, 1897.

Newtons Bend.—This revetment was completed between low water and 4½-foot stage November 8 to December 16, 1897. The stone used was purchased, delivered on the bank, near by.

Newtons Crossing.—This crossing, at the head of Newtons Bend, became very shallow in September, the water being divided in several channels. To correct this a low-water dike 370 feet long was built. It heads at a gravel lump that is in the line of the training wall of Dike F, extended down stream 750 feet, and has the same direction of the training wall. It is built of riprap stone on brush mattress foundation, the mattress being 28 feet wide. Some of the stone used was procured at Ives Point and towed to the work by the *Wichita.* The rest of the stone was towed from Greathouse Bend by the chartered steamer *Irma*, the *Wichita* being too heavy to pass over the crossing. The brush was procured by hired labor at Rectors Island. This work maintained a navigable channel over the crossing for the *Irma* with a barge in tow, after this boat was unable to pass over Big Rock Crossing (7½ miles below) or over the crossing at the head of Rectors Island (3 miles above).

Little Maumelle.—This place, as at Newtons Crossing, was shallow and the water was divided. A low-water dike similar to that described above was built here. It started from the left bar, opposite and 500 feet above the mouth of Little Maumelle Creek, is built 420 feet diagonally down stream; from here it extends 590 feet down stream parallel to and about 175 feet from the right bank. The brush was procured at Rectors Island and the stone was towed to the work from Greathouse Bend. This dike and the one at Newtons Crossing are submerged when the river is 1 foot above ordinary low water.

REPAIR WORK AT PINE BLUFF.

Dike 2.—Rebuilding the shore protection at this dike began last fiscal year and was completed July 14 of this year. From a point 400 feet above the dike to a point 640 feet below it the bank was graded and riprapped to 20-foot stage. Along this portion of the bank and below low water a brush mattress 120 feet wide was placed. Eighteen old brace piles were removed from below the dike. The rock used was a portion of that stored at Pine Bluff in fiscal year 1896.

Revetment below Mallorys ditch.—This revetment was built in fiscal year 1892. The mattress near low-water line was broken in many places and the bank was badly cut by gullies. The original work was never completed, there being 4,300 feet of it that was not riprapped between low water and 5 to 7 foot stage, this portion of the bank being held by mattress. This 4,300 feet was regraded and covered with stone and 500 feet of the old riprap was taken up, the bank regraded and the riprap relaid. These repairs were commenced October 1 and were completed November 6, 1897. This work, in connection with that done at Dike 2, used all the stone that was stored at Pine Bluff in fiscal year 1896.

PRIVATE WORK.

The St. Louis and Southwestern Railroad Company built, July 15 to October 1, 3,500 linear feet of shore protection at Rob Roy Bridge. The plant used belonged to the United States and was loaned the company by the honorable Secretary of War. The mattresses used varied in width from 82 to 130 feet. The bank was riprapped to 20 foot stage. The cost of the work is given me as $18,766.29, or a little over $5.36 per linear foot of bank protected.

MATERIAL ON HAND.

When work was suspended in January of this fiscal year there was stored on the banks of the Arkansas River material as indicated below:

Locality.	Purchased from—	Kind of material.	Quantity.	Cost per unit.
Ross Hollow	L. Adams	Stone	2,198 cubic yards	$0.35
Natural Steps, Scotts Eddy, and Ives Point.	B. B. Rogers	do	1,399 cubic yards	.49
Ives Point	Fred. Hanger	do	1,426 cubic yards	.53
Pine Bluff	do	do	1,120 cubic yards	1.40
Dike N	Lewis & Chapman	Piling	67 pieces, 16 to 21 feet long.	*a* .15
			20 pieces, 27 to 32 feet long.	*a* .12½

a Per foot.

Exhibit of field expenditures on the various works mentioned above are given below.

Exhibit of field expenditures, completing Fletcher's and Reid's bend revetments.

	Fletcher's.			Reid's.		
	Quantities.	Cost per unit.	Cost per item.	Quantities.	Cost per unit.	Cost per item.
Regrading and replacing old riprap			$287.67			
Stone on bank at Natural Steps, cubic yards	704.2	$0.490	345.06	63	$0.490	$35.43
Stone on bank at Ives Point, cubic yards				1,304.9	.530	691.60
Labor, loading on barges and placing in work .... cubic yards	704.2	.404	284.30	1,367.9	.580	794.01
Towing stone .... do	704.2	.310	218.50	1,367.9	.365	500.00
Total cost of stone in place, cubic yards	704.2	1.611	1,135.53	1,367.9	.903	1,235.93
Miscellaneous.						
Property purchased			7.50			8.25
Repairs to plant			32.50			32.88
Total miscellaneous			40.00			41.13
Total field expenditures, fiscal year 1898			1,175.53			1,277.06
Expended in previous years			23,072.94			18,769.11
Total field expenditures			24,248.47			20,046.17

Exhibit of field expenditures, completing training wall at Dike F.

	Quantities.	Cost per unit.	Cost per item.
Stone purchased delivered in place .... cubic yards	166	$0.80	$132.80
Supervision, inspection, etc .... do	166	.04	6.64
Total cost of stone in place .... do	166	.84	139.44
Expended in previous years			3,863.69
Total field expenditures			4,003.13

Exhibit of field expenditures, repairing Dam I and completing Dike L.

	Dike L.	Dam I.		
	Cost.	Quantities.	Cost per unit.	Cost per item.
Labor, finishing and shaping up dike	$18.00			
Stone on bank at Natural Steps .... cubic yards		66.3	$0.490	$32.49
Labor, loading and placing stone in dam .... do		66.3	.414	27.45
Wichita, towing stone .... do		66.3	.302	20.00
Total cost of stone in place .... do	18.00	66.3	1.206	79.94
Expended in previous years	3,053.23			5,877.11
Total field expenditures	3,071.23			5,957.05

Exhibit of field expenditures, building superstructure, Dike M.

	Quantities.	Cost per unit.	Cost per item.
37 piles, delivered on bank at work ..... linear feet..	777	$0.150	$116.55
7 stringers, delivered on bank at work ..... do....	224	.125	28.00
Bolts (1 inch by 30 inches) ..... pounds..	337	.060	20.22
Labor, driving piles and putting up stringers			153.26
Cost of superstructure (without brush screen)			318.03
Expended in previous years			1,444.16
Total field expenditures			1,762.19

Exhibit of field expenditures, completing Newtons Bend revetment.

	Quantities.	Cost per unit.	Cost per item.
Stone, delivered on bank ..... cubic yards..	866	$0.750	$649.50
Labor, placing stone in revetment ..... do....	866	.775	670.85
Total cost of stone in place ..... do....	866	1.524	1,320.35
Expended in previous years			10,929.44
Total field expenditures			12,249.79

Exhibit of field expenditures, building low-water dikes at Newtons Crossing and Little Maumelle.

	Newtons Crossing.			Little Maumelle.		
	Quantities.	Cost per unit.	Cost per item.	Quantities.	Cost per unit.	Cost per item.
Mattress.						
Labor, driving mooring piles	9	$1.823	$16.41			$33.71
Cutting, hauling, and loading brush, cords	70	1.670	116.74			336.10
Wire ..... pounds..	200		5.00	500		9.50
Weaving mattress ..... squares..	103.6	.853	88.36	307	$0.603	185.15
Towing brush ..... cords..	70	.631	44.25			60.00
Total cost of mattress ... squares..	103.6	2.614	270.76	307	2.034	624.46
Stone.						
Stone on bank at Ives Point, cubic yards	322	.530	170.66			
Royalty on stone ..... cubic yards..				175	.040	7.00
Quarrying and hauling stone ..... do....				175	.992	173.63
Stone on bank at Little Maumelle . do....				136	.750	102.00
Stone on bank at Greathouse Bend . do....				260	.750	195.00
Picked up under bank, Little Maumelle ..... cubic yards..				116		
Labor, loading on barges and placing in work ..... cubic yards..	322	.989	318.42	687	.950	652.67
Towing stone ..... do....	322	.419	135.00	687	.426	292.50
Total cost of stone in place . do....	322	1.938	624.08	687	2.071	1,422.80
Total field expenditures .... do....			894.84			2,047.26

Exhibit of field expenditures, repairs at Pine Bluff.

	Dike No. 2.			Revetment below Mallorys Ditch.		
	Quantities.	Cost per unit.	Cost per item.	Quantities.	Cost per unit.	Cost per item.
Regrading bank.						
Labor .... linear feet	1,040	$0.190	$197.37	4,300	$0.105	$450.00
Explosives			17.10			
Total	1,040	.206	214.47	4,300	.105	450.00
Anchor piles.						
Piles purchased .... number	12	2.417	29.00			
Labor and fuel, driving piles .... do	12	1.192	14.31			
Total	12	3.609	43.31			
Mattress.						
Brush, purchased on barges .... cords	621	1.20	745.20			
Poles, purchased on barges .... number	1,392	.05	69.60			
Wire purchased .... pounds	3,909	.15	58.63			
Rope .... do	500	.065	32.50			
Towage			204.00			
Labor, weaving mattress .... squares	1,248	.384	480.21			
Total cost of mattress .... do	1,248	1.274	1,590.14			
Stone.						
Value in storage yard .... cubic yards	2,152.44	1.21	2,604.45	3,182.23	1.21	3,850.50
Labor, loading .... do	2,152.44	.187	403.33			
Towage .... do	2,152.44	.111	238.25			
Labor, placing .... do	2,152.44	.179	384.33			
Labor, cleaning deposit off of						18.40
Labor, loading and placing .... cubic yards				3,182.23	.483	1,536.00
Total cost of stone .... do	2,152.44	1.687	3,630.36	3,182.23	1.698	5,404.90
Miscellaneous.						
Removing and replacing 500 linear feet of old riprap .... cubic yards				430	.360	154.80
Unclassified labor						44.42
Miscellaneous material			20.92			51.00
Transfer of plant, Little Rock to Pine Bluff and return			55.00			82.50
Total miscellaneous			75.92			332.72
Total field expenditures			5,554.20			6,187.62

It is a difficult matter to apportion among the various works the general expenses necessarily incurred while two or more works are in progress at the same time. Surveys are made to determine the results of the works built as well as to determine locations of new works. A part of this expense should be charged to the old works and part of it to the new. Plant is repaired, partly on account of damage done while in use at old work and partly to put it in good condition for use in new work. Care of property and general office expenses during the time that work is suspended are subject to the same distribution. Because of the difficulty of apportioning this class of expenditures, the tabulations of cost of the various works built since July 1, 1894, have only shown the field expenses. On that date, July 1, 1894, no work was in progress, because of the small amount of funds available, neither was there any work that was unfinished. The same condition exists now, and by apportioning the unclassified expenses among the several works built since July 1, 1894, the table below has been arranged for the purpose of showing, approximately, the actual cost of the work done on the present project from July 1, 1894, to July 1, 1898.

COST OF WORKS BUILT FOR THE IMPROVEMENT OF ARKANSAS RIVER, ARKANSAS, JULY 1, 1894, TO JULY 1, 1898.

Financial statement.

Amount unexpended July 1, 1894	$15,875.93	
Appropriated August 17, 1894	240,000.00	
Appropriated June 3, 1896	85,000.00	
		$340,875.93
Amount unexpended July 1, 1898	5,973.39	
Value of stone on hand July 1, 1898	3,773.59	
Value of piling on hand July 1, 1898	229.72	
		9,976.70
Amount expended on project, July 1, 1894, to July 1, 1898		330,899.23

Itemized list of works built and total cost of same.

Ainsworth Crossing, 2 dikes rebuilt	$1,758.06
Bruce Island, dam rebuilt	3,835.80
Bruce Island, dredging	7,008.00
Fort Smith, Suter Dike repaired and 3 dikes built	21,562.62
Fletchers Bend, revetment	35,402.76
Fletchers Bend, 2 dikes	6,212.13
Reids Bend, revetment	29,267.41
Reids Bend, 3 dikes	7,864.64
Rectors Island, 1 dike and 1 dam	16,284.34
Crystal Hill, 2 dikes and 1 training wall	17,947.06
Newtons Bend, revetment	17,884.54
Newtons Bend, wrack heap	1,420.87
Newtons Crossing, low-water dikes	4,188.44
Little Maumelle, low-water dikes Little Maumelle, dredging	2,489.30
Greathouse Bend, revetment	24,078.58
Greathouse Bend, 2 dikes	6,568.03
Little Rock, repairs to Dike D	814.85
Pine Bluff, repairs to Dike 2	8,102.25
Pine Bluff, repairs to revetment below Mallorys Ditch	8,944.66
Below Pine Bluff, works for temporary improvement	8,461.63
Red Fork, revetment	69,701.80
Plant built, small barges for temporary improvement work	761.97
Plant built, dredge *Van Frank*	19,701.51
Plant built, 100-foot barges	10,637.98
Total cost of works	330,899.23

PLANT.

Condemned.—Quarter boats *Lisette* and *Yorktown;* pile drivers, 2; barges (20 by 60 by 3), 19.

Repaired.—No extensive repairs were made to any of the boats or barges, the building of a skylight on the towboat *Cleveland* being the largest. Necessary minor repairs, to keep the plant in working condition, were made.

On hand.—Snag boat *Beauregard;* condition, poor. Snag boat *Wichita*; condition, bad. Snag boat *C. B. Reese;* condition, useless. Towboat *Cleveland*; condition, fair. Barges A192, A195, A295, A395, A495, B194, 128, and 129. Also six small barges used in work for temporary improvement, and one store boat. All the barges, excepting 128 and 129, are in fair condition.

CHANNEL AND RESULTS OF WORK.

The average low water at Little Rock is about 2.5 feet on the Weather Bureau gauge at Little Rock. The average low-water discharge at that place has been considered as 2,400 cubic feet per second.

In the last Annual Report the statement was made that it was believed a low-water channel of 2½ to 3 feet had been made over the crossings in the first 21 miles above Little Rock. Nothing developed during the low water of last fall to change this belief, so long as the low-water discharge of the river was not less than 2,400 cubic feet per second and after a cut-out stage had been reached. On September 6, Little Rock gauge, 3 feet falling, the snag boat *Wichita* found 18 inches at the lower end of Newtons Crossing. This was a rolling sand reef. The boat lay on it that night, and next morning went over the crossing with 2 feet in the channel and it still cutting. The river continued to fall, reaching 2 feet on the gauge October 1. Channel depths from this date to end of low-water season are tabulated below.

Channel depths on the crossings, on trial reach, above Little Rock, Ark., October 1, 1897, to January 3, 1898.

Name of crossing.	Dates and gauge reading at Little Rock.				
	Oct. 1: Gauge 2.0.	Oct. 5: Gauge 1.7.	Oct. 13: Gauge 1.7.	Oct. 22: Gauge 1.3.	Jan. 3: Gauge 3.1.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Palarm	....	2.5	....	2.2	5.5
Natural Steps	....	2.7	2.5	2.5	5.5
Head of Rectors Island	1.8	2	1.6	1.7	4
Newtons (upper end)	1.9	2	1.6	1.4	4
Newtons (lower end)	1.3	1.9	1.6	1.6	3.5
Little Maumelle	1.5	1.6	1.5	1.6	4
Big Rock	1.7	....	1.7	1.4	3.5

These depths were greater than those that existed in the unimproved parts of the river at the same time, as will be seen by the following:

Place.	Below Pine Bluff.	Date.	Little Rock gauge.	Channel depth.
	Miles.			*Inches.*
Corinne	11	Dec. 29	3.7	24
Victoria	12	Dec. 30	3.6	20
Maddings	16½	Sept. 11	2.7	15
Swan Lake	27½	Sept. 21 to Oct. 9	2.6 1.7	20
Simpsons	30	Oct. 16	1.6	20
Reydells	55	Oct. 23	1.3	15
Pendleton	66	Nov. 6 to Dec. 19	1.2 1.8	11
Head of White River Cut-off	95	Nov. 11	1.2	19

The low-water discharge at Little Rock in the autumn of 1897 was only 1,170 cubic feet per second, and is the smallest discharge that this office has any record of. Humphrey and Abbott give a low-water discharge of 2,318 cubic feet per second at the mouth of the river November 4, 1858. No statement is made whether any water was running through the White River Cut-off or not. A discharge of 2,318 cubic feet per second at the mouth of the river, with no water running through to White River, would correspond with a discharge of about 1,200 cubic feet per second at Little Rock.

The results obtained in 1896 seem to indicate that with a low-water discharge of not less than 2,400 cubic feet per second the present plan, if the work can be held, would give a navigable channel depth of from 24 to 30 inches above Little Rock and from 30 to 36 inches below Little

Rock, but with the lower-water discharge of 1897 a navigable channel can not be obtained at all. It is, in my opinion, impracticable to obtain at low water the depth called for in the approved project from Little Rock to the mouth, viz, 6 feet.

EFFECTS OF RECENT FLOOD ON TRIAL REACH, JUST ABOVE LITTLE ROCK.

The work in this reach has consisted of revetting caving banks, closing all channels but one, and in holding the heads of the bars at the foot of the bends, the object being to keep the channel in one place. No attempt has been made to control the high-water flow.

The height of the dikes used is from 5 to 8 feet above low water near their root. Those built prior to 1896 have level crests. The crests of those built since slope down to nothing at the low-water line desired.

The bank protection consists of a single-weave mattress, extending from low-water line 60 feet out into the channel, with bank graded to slope of 1 on 2 to a 15-foot stage and paved with stone. Bank is similarly protected at root of dikes for a distance of from 200 to 300 feet. About 50 feet of this protection is on the upstream side of the dikes. The riprap is carried to 20-foot stage.

The work in this reach has been in place from one to three and a half years. With the exception of the loss of one short dike in December, 1895, the work had not been damaged by floods prior to that of May, 1898. This flood was characterized by extreme velocities. The river at Fort Smith was 4.5 feet higher than in 1892, which is ordinarily assumed as high water. At Little Rock the stage was 0.7 foot lower than in 1892. The surface slope was consequently greater than in ordinary floods and the velocity of the current greater. This flood has developed several weak points in the approved plan of construction, and shows the difficulty of holding the roots of dikes and the liability of the river to flank all or certain parts of the revetment.

The bars opposite the bends in the Arkansas River being low, the high-water route is across the points of the bars, and the dikes constructed at the heads of the bars (to hold the bars and to give the proper direction to the low-water channel) lie directly in this high-water route, and it is a difficult problem to prevent the river from cutting the channel behind the roots of these dikes, unless the high-water channel is controlled so as to make the water follow the bends at all stages. Without controlling the high-water flow so as to relieve these dikes, the only additional strengthening that I can see would be to carry the riprap to the top of the bank and to dig trenches perpendicular to the protection at the roots of the dikes and nearly fill them with stone, so as to prevent a channel being cut behind. Whether this would hold them during such floods as that of May, 1898, is doubtful.

The cause of the damage to and flanking of parts of the revetments seems to be due in most cases to the fact that the riprap was carried only to a 15-foot stage and not to the top of the bank. During floods the bank is cut above the riprap. This cutting continues until a bench of considerable width exists behind the riprap. When this bench is wide enough and long enough a channel commences to cut along the rear edge of it, and the riprap falls in at the upper and lower ends of this channel. This action continues until a break is made through a short piece of the revetment at the upper and lower ends of the damaged portion, leaving the remainder of the revetment practically intact, but flanked.

The character of work done on the Arkansas River seemed permanent as long as the river stayed within its banks, but it can not withstand such floods as those of May, 1898, which was higher at Fort Smith by 1.2 feet than any flood since 1833.

The approved estimate for improving that portion of the river above Little Rock is $4,570 a mile, below Little Rock $14,424 a mile. Regarding this improvement, the conclusions reached are that the regulation of such a stream as the Arkansas must include the control of both the high and low water flow of the stream; that all bank protection must extend to the top of the bank; that such regulation will cost about $35,000 a mile above Little Rock and about $50,000 a mile below; that an attempt to permanently improve 773 miles of such river by the expenditure of from $50,000 to $125,000 a year is futile.

The snagging operations and closing secondary low-water channels by temporary structures in those parts of the river that are being navigated are beneficial to navigation, and should, in my opinion, be continued.

If the permanent work is to be continued, an economical management of the work would require an annual appropriation of not less than $300,000. In this connection it is to be observed that floating plant, consisting of wooden barges and steamboats, deteriorates rapidly, and this action goes on just as rapidly when the plant is idle as when at work. There are other expenses, for watchmen, custodians, laborers, etc., that can not be avoided when the plant is idle. The amount that can be profitably expended during the fiscal year ending June 30, 1900, is $500,000; of this a large amount will be required to replace plant that has become unserviceable and has been condemned, and also to repair the flood damages of this year.

Appended is a table showing the highest and lowest stages of the river at Little Rock for each month since the establishment of a river gauge at that point. The gauge records are made to correspond with the present Weather Bureau gauge. No correction has been made for river slope, as the present gauge is only 1,450 feet upstream from the original gauge and 970 feet upstream from the gauge in use since August 30, 1883. Some results of discharge observations, not previously reported, are also appended.

Money statement.

July 1, 1897, balance unexpended		$49,645.39
June 30, 1898, amount expended during fiscal year	$40,963.54	
Less refundments	183.60	
		40,779.94
July 1, 1898, balance unexpended		*8,865.45
July 1, 1898, outstanding liabilities		350.00
July 1, 1898, balance available		8,515.45
Amount (estimated) required for completion of existing project		Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1900		500,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.		

APPROPRIATIONS.

Prior to 1886 appropriations were made for special works. The act of August 5, 1886, and subsequent ones made appropriation for the improvement of the river in accordance with approved project. The acts of August 17, 1894, and June 3, 1896, also made appropriations for removing obstructions and operating snag boats.

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* $2,891.06 for removing obstructions, $5,974.39 for project.

The appropriations are as follows:

SPECIAL WORK.

June 14, 1880 (Pine Bluff)	$25,000.00	
March 3, 1881 (Pine Bluff)	23,000.00	
August 2, 1882 (Pine Bluff)	20,000.00	
July 5, 1884 (Pine Bluff)	55,500.00	
July 5, 1884 (Fort Smith)	5,000.00	
August 5, 1886, part (Pine Bluff)	8,000.00	
August 5, 1886, part (Fort Smith)	13,000.00	
August 5, 1886, part (Dardanelle)	10,000.00	
		$159,500.00

PRESENT PROJECT.

August 5, 1886 (part)	44,000.00	
August 11, 1888	150,000.00	
September 19, 1890	180,000.00	
July 13, 1892	250,000.00	
August 18, 1894 (part)	240,000.00	
June 3, 1896 (part)	85,000.00	
		949,000.00

REMOVING OBSTRUCTIONS.

August 18, 1894 (part)	10,000.00	
June 3, 1896 (part)	15,000.00	
		25,000.00
Total appropriations		1,133,500.00
Expended to June 30, 1897	1,089,243.89	
Less sales and refundments	5,389.28	
Net expenditures to June 30, 1897		1,083,854.61
Unexpended July 1, 1897		49,645.39
Expended to June 30, 1897, on special work		159,500.00
Expended to June 30, 1897, on project		904,803.95
Expended to June 30, 1897, on removing obstructions		19,550.66
Total		1,083,854.61

COMMERCIAL STATISTICS.

This year is one remarkable for the continuous time that the river was at an unnavigable stage. The tabulation, given below, is arranged from information furnished by the masters of the various steamers plying this stream. The river might be subdivided further, but the divisions given are the principal ones.

Table showing the length of time that the Arkansas River was unnavigable during the year ending May 31, 1898.

Between—	Miles.	Dates.	Time.
Webbers Falls and Fort Smith	62	Aug. 15 to Jan. 19	5 months, 4 days.
Fort Smith and Dardanelle	107	Aug. 15 to Jan. 16	5 months, 1 day.
Dardanelle and Cribbs Landing	67	Aug. 20 to Jan. 16	4 months, 27 days.
Cribbs Landing and Little Rock	20	Oct. 22 to Dec. 16	1 month, 24 days.
Little Rock and Pine Bluff	66	Aug. 22 to Dec. 22	4 months.
Pine Bluff and Swan Lake	28	Sept. 7 to Dec. 21	3 months, 14 days.
Swan Lake and Pendletons	38	Nov. 6 to Dec. 19	1 month, 13 days.
Pendletons and mouth	42	Nov. 9 to Nov. 28	19 days.

The river was also unnavigable between Webbers Falls and Cribbs Landing for about fifteen days in February and March, and for about five days in March, between Little Rock and Pine Bluff.

The river trade between Pine Bluff and the mouth of the river is handled by a packet line out of Memphis, Tenn., that endeavors to navigate the river all the year. The packet line between Pine Bluff and Little Rock was reestablished this year. The steamboat that formerly operated out of Webbers Falls is now in the Little Rock and Dardanelle trade, its place on the upper river being taken by a gasoline boat. A very small steamboat endeavors to run the year round between Little Rock and Fourche River. Steamboats from the Mississippi River come into this when freights are assured them. Of these boats and the business done by them complete information could not be obtained. No boat has reported navigating the river above Webbers Falls during the year.

List of stern-wheel boats navigating Arkansas River, Arkansas, May 31, 1897, to June 1, 1898.

Name.	Tonnage.	Draft, loaded.		Between—	Round trips.	Passengers.
		Steamers.	Barges.			
		Ft. In.	Ft. In.			
Dardanelle	164	3 0	3 0	Little Rock and Pine Bluff	22	205
				Little Rock and Shoal Creek	3	
				Little Rock and Roseville	1	
				Little Rock and Pontoon	1	
Eugene	509	5 0	....	Memphis and Pine Bluff	12	361
J. P. Gage	198	4 0	....	Memphis and Dardanelle	1	....
J. N. Harbin	342	3 0	....	Memphis and Pine Bluff	32	1,018
				Memphis and Pendleton	5	
				Memphis and Reydels	1	
				Memphis and Simpsons	1	
				Memphis and Swan Lake	3	
				Helena and Pine Bluff	2	
				Helena and Simpsons	1	
				Helena and Hannabery	1	
				Helena and Douglass	1	
Myrtle B	77	2 6	(?)	Fort Smith and Webbers Falls	20	....
Irma	151	3 0	3 0	Short trade out of Little Rock	88	447
New Mary Morgan	137	3 0	2 6	Little Rock and Dardanelle	3	158
				Little Rock and Cardens Bottom	16	
Portia	50	3 0	4 6	Mississippi River and Little Rock	1	....
Wm. Druhe No. 2	179	3 6	3 0	Dardanelle and Little Rock	24	(?)
Huston Combs No. 2	96	3 0	(?)	Vicksburg, Miss.. and Arkansas Post	1	....
Terrapin	(?)	(?)	(?)	Little Rock and Fourche River	(*a*)	(*a*)

a No report rendered.

Classification of commerce reported.

	1898.		1897.	1896.	1895.	1894.
	Value.	Tons.	Tons.	Tons.	Tons.	Tons.
Cotton	$778,720	4,867	5,605	4,437	4,274	7,213
Cotton seed	177,120	22,140	12,285	9,576	9,146	38,310
Hides and skins	900	12	30	8	12	31
Live stock	1,320	33	158	241	175	287
Lumber	3,185	637	640	4,112	2,733	2,616
Staves and bolts	43,459	12,072	8,175	170	513	250
Provisions	191,840	1,199	585	3,580	2,033	4,647
Grain	12,790	1,279	445	1,579	1,992	3,185
Saw logs	19,622	9,811	23,219	19,070	17,400	1,240
Hewn piles	45,000	3,000	11,930	1,545	....	....
Miscellaneous freight	352,800	3,528	2,975	9,943	12,220	5,784
Total tons	....	58,578	66,077	54,261	50,498	63,563
Total value (estimated)	1,626,756	....	$1,657,218	$2,408,720	$2,380,420	$2,846,395

Stages of the Arkansas River.

Highest and lowest stages of the Arkansas River at Little Rock, Ark., each month from January, 1872 to December, 1897, inclusive. Gauge referred to is the Weather Bureau gauge established on Little Rock Free Bridge, December 10, 1897, the earlier records being changed to correspond with this.

Month.	Highest stage.		Lowest stage.	
	Date.	Gauge.	Date.	Gauge.
1872.				
January	23	12.8	4	4.8
February	25	6.1	5	4.3
March	28	9.1	21	3.7
April	11	16.9	30	5
May	20–21	27.6	1	5
June	2	27	29	8.5
July	22	23	6	7.6
August	1	10.1	31	4.9
September	1	4.6	15	3.6
October	1–2	3.6	25–28	2.7
November	9	4.8	1–4	2.8
December	1 & 19	2.8	4–5 14–15	2.4
1873.				
January	7–8	8.7	1, 3	2.7
February	19	14.6	4–5	3.8
March	4	8.3	26	4.3
April	12	24.2	1	4.4
May	22	19.6	1	8.4
June	2	14.8	30	7.3
July	12	10.1	29	3.4
August	7	4.7	29–31	2.2
September	30	6.7	23–26	2
October	2	11.7	18	2.6
November	9	4.3	20–22	2.5
December	13	20.5	2	2.9
1874.				
January	27	15.2	20–21	3.5
February	26	21.6	20–21	8
March	8	18.7	31	9.5
April	25	24.6	3–4	9.3
May	1	17.2	31	7.1
June	17	8.7	9	5.4
July	2–3	5.8	27–28	2.8
August	1	2.9	27–31	1.6
September	27	9.7	4–7	1.5
October	1	9.2	31	2.8
November	30	4.4	11–12, 14	2
December	31	6.4	15–18	3.5
1875.				
January	4	12.6	26–27	2.9
February	1	9.4	28	4.2
March	31	10.8	1	4.3
April	4	17.6	24–25	6.4
May	5	22.6	19	9
June	2	17.6	30	5.4
July	28	13.5	15	3.8
August	5	23.4	28	5.5
September	2	7.3	26–27	4.4
October	1–2	5.5	30–31	2.5
November	13	2.7	27	2
December	27	4.7	17–18	2.1
1876.				
January	30	23.6	1	4.3
February	1	19.6	29	5.6
March	28	24.1	4	4.5
April	5	24.7	26	9
May	13	19.9	24	8.1
June	20	13.6	13	7.4
July	7	27.9	31	8.3
August	2	11.4	23	5.1
September	3	8.2	19–23, 30	3.5
October	24	4.1	18	2.5
November	11	5.3	3–4	3.1
December	1	4	29–30	2.7
1877.				
January	23–25	3.4	9	2.7
February	9	7.9	1	3.1
March	15–16	5.8	6–7, 10	4.4
April	30	19.3	1	5.1
May	24–25	24.6	14	9.4
June	13	29.1	6	13.1
July	3	18.3	24–25	6.9
August	1	9.1	30	5.8
September	2	6.3	15	4.3
October	21	14.2	10–16	3.6
November	4, 25	15.2	17–19	7
December	27	19.7	19	7.8
1878.[a]				
January	24	19.2	31	12.7
February	26	22.4	18–20	10.4
March	11	17.1	28–31	8
April	27	23.4	1–2	7.8
May	28	25.9	18	7.1
June	1	21.6	13	9.8
July	2	16.1	27	6.3
1879.				
January	20	11.7	1	2.4
February	3	18.2	26–28	6.3
March	19	6.4	31	4.3
April	30	11.4	24–25	3.6
May	9	13.5	31	3
June	7	6	20–24	2.2
July	9	6.5	29	2.1
August	25	6.9	6	2.2
September	1	2.6	30	.6
October	25–28	1	12–22	.6
November	25–26	3.4	1–13	.8
December	26	8	1, 7–9	2.6
1880.				
January	7	9.2	30	3
February	16–17	13.3	8–9	3.4
March	14	16.1	31	6.4
April	9	11.4	16–17	5.1
May	1	7.6	30	1.6
June	6	6.3	28	1.6
July	14	7.8	2	2.1
August	7–8	5.4	28	2
September	5	4.7	24	1.5
October	19–22	1.8	13–14	.9
November	14	4.8	6–7	.8
December	6	3.8	29	1.7
1881.				
January	21, 23	5.8	11	.7
February	20	18.6	1–3	3.2
March	1	14.8	16, 31	7.7
April	17	8.2	12	4.7
May	27	15.7	4–5	4.7
June	1	11.9	26	4.3
July	5	11.8	26–27	2.1
August	12	5.7	29–31	1–5
September	21	4	16–17 29–30	1.3
October	8–9	12.9	1	1.8
November	18–19	13.7	11	4.8
December	26	12.4	13	4.1
1882.				
January	18–19	13.6	10–11	4.6
February	24–25	25.1	7	7.9
March	1	20.4	30	9.7
April	1	10.1	27	5.3
May	11	24.3	1	5.2

[a] No record after August 3.

Stages of the Arkansas River—Continued.

Month.	Highest stage.		Lowest stage.	
	Date.	Gauge.	Date.	Gauge.
1882.				
June	3	19.3	30	8.2
July	1	7.6	18–19	4.3
August	1	6.1	30–31	2.6
September	28	3.9	20–26	2.2
October	21	12.3	2–3	3
November	24–26	8.5	7	4.9
December	24–25	8.5	19–20	3
1883.				
January	8	12.2	26–27	4.3
February	20	24.4	5	7.4
March	1	23.2	28–29	6.1
April	8	15	5	7.6
May	24	18.5	19	5.3
June	14	24.1	30	9.1
July	21	*a* 14.4	15–17	5.8
August	14	*a* 11.7	31	4.9
September	27–28	5.5	11	3.5
October	23	14.3	9–13	3.8
November	24	11.3	22	5.7
December	9	18.3	29	6.4
1884.				
January	1	6.6	29–30	4.6
February	16	27	1	5.1
March	1	12.8	23	8.2
April	29	14.6	11	8.2
May	6	24.6	31	10
June	6	12.8	25–26	8.3
July	4	11.3	26	7.1
August	1	8.8	18	4.6
September	6	7.4	16–17	4.3
October	8	13.1	27	4.1
November	30	9.8	20	4.1
December	31	23.6	7–8	6.1
1885.				
January	1	24.1	27–28	8.8
February	11	16.3	25	6.8
March	4	16.4	25–26	9.5
April	27	26.6	21	8.4
May	1	24.3	18	10.5
June	29	18.3	13	9.8
July	10	21.2	31	8.8
August	20	9	31	5.9
September	15	17.9	7	5.6
October	1	5.6	26–30	4.1
November	9	5	28–30	3.7
December	31	4.3	26–29	3.5
1886.				
January	5–7	6.1	1	4.6
February	15	16.6	8	5.1
March	14	10.9	28–29	6.9
April	21	14.9	11	8.5
May	2	12.3	30–31	4.4
June	16	9.7	10–11	3.6
July	28	8.7	24–25	3.1
August	12	13.7	31	3.5
September	19	7.3	5	3.1
October	1	5.8	26–28	2.1
November	25	8.8	2, 8	2
December	1	4.1	21–23	2.1
1887.				
January	26	4.6	2	*b* 1.8
February	16	13.9	1	3.3
March	9	11.2	26, 31	3.9
April	29	3.7	19	1.9
May	6	16.5	3	4.4
June	20	8.8	30	4.4
July	14	6.3	31	2.4
August	1	2.3	16–17	1.6
September	15	3.8	2	1.7
October	16	8.5	9–11	1.6
November	1	2	21–23	1.1
December	7	10.1	1	1.4
1888.				
January	15	5.8	6–7	2.6
February	8	10.5	25	4.2
March	28	14	24	5.3
April	15	17.5	29	4.7
May	23	18.4	16–17	5.9
June	14	16.5	10–11	6.2
July	1	13.1	26–27	4.3
August	31	4.8	22	2.4
September	3	14.4	30	2.4
October	4	2.9	27–31	2
November	22	8.6	2–3	1.9
December	31	17.4	6–9	3.3
1889.				
January	19	21.2	8	8.7
February	1	13.4	19	6.8
March	28	21.5	1	7.2
April	1–2	17.1	22–23	8.4
May	26	15.4	16–17	6
June	25–26	15.9	15	7.2
July	31	17.7	18–21	5.8
August	1	16.4	30–31	4.2
September	17	10.2	1	4.2
October	1	4	11–16 22–31	2.8
November	15	12.1	1	3
December	1	14.3	31	4.2
1890.				
January	18	17.3	14	9.7
February	28	19	2	9.5
March	14	22.3	11	9.6
April	29–30	24.3	15	10.8
May	1	23.7	30	9.3
June	8	13.7	25	6.2
July	2	7.3	31	4
August	24	10.1	18	3.2
September	26	15.6	10–11	6.1
October	27	12.4	8	7.8
November	21	19.7	8–11	5.7
December	30	15.1	24	5.8
1891.				
January	13	15.2	30	9.3
February	27	14.5	20	8.1
March	10	12.7	28	8.5
April	23	20.9	13	8.1
May	9	16	22	7.2
June	11	19.8	21	10.7
July	1	16.5	27–28	6.1
August	2–3	19.1	29	4.1
September	1	4.4	26–30	3.1
October	7	4.9	2–5	2.9
November	24	7.2	11–13	2.7
December	26	7.9	2	3.8
1892.				
January	4	10.3	18	*c* 4.4
February	23–24	11.7	3–4	5.6
March	27	18.9	1	8.5
April	9–10	20	19	9.1
May	20	*d* 27.9	7	9.4
June	6	25.8	30	9
July	9	11.3	24	8.6
August	1 & 31	8.5	13	7
September	4	9.2	29–30	6.3
October	27	11.4	14	5.4
November	6	11	25	6.5
December	16	19.9	6–7	6.6
1893.				
January	3–4	15.4	23–24	6.7
February	26	13.7	14	6.4
March	11	16.9	23	8.3
April	30	19.9	12–13	6.6
May	3	25.2	27	9.5
June	3	21.5	30	7.3

[a] Approximated from Baring Cross gauge, 1 mile above.
[b] May have gone lower. River frozen, January 3–13.
[c] May have been lower. River frozen, January 19–22.
[d] Extreme height was 28.2 in afternoon.

Stages of the Arkansas River—Continued.

Month.	Highest stage.		Lowest stage.	
	Date.	Gauge.	Date.	Gauge.
1893.				
July	5	16.7	31	5.3
August	19	7.9	7	4.6
September	30	11.7	23	3.3
October	7	12.5	29–31	3.5
November	30	7.4	11 & 19	2.9
December	2	8.5	14	4
1894.				
January	24	12.7	10–13	3.5
February	10	20.5	2– 3	6.5
March	22	22.6	5	7
April	28	14.1	10	7.1
May	3	17.6	31	5.6
June	20	9.9	4 & 16	4.9
July	5	11.4	30–31	3.9
August	14	4.8	31	3
September	18	9.8	3– 4	2.9
October	1	5	31	2.9
November	6	3.8	26–29	2.3
December	12	4.7	1	2.3
1895.				
January	28–29	5.6	3– 6	2.5
February	1	4.5	*a* 18–22	*a* 3
March	16	9.4	1– 2	3.1
April	2– 3	6.3	25–26	3.3
May	5	4.3	31	2.5
June	22	8.6	1	2.6
July	15	18.5	2	5.9
August	3	19.1	28	6.8
September	15	15.6	30	4.6
October	1	4.3	31	2.9
November	15–16	5.4	6– 8	2.7
December	29	23.5	18–19	3.4
1896.				
January	1	21.3	21–23	8.7
February	15	13	29	7.6
March	20	10.7	2– 3	7.3
April	3	14.5	22	7.2
May	26	18.8	18	5.8
June	5	16.8	27	5.2
July	28	14.3	26	4.5
August	1	9	28	3.5
September	1– 2	3.6	17–21	2.8
October	30–31	3.9	22	2.6
November	8	6.7	25–26	3.1
December	3	9.2	30–31	3.5
1897.				
January	7	19.4	2	3.4
February	13	10.2	6	5.5
March	22	20.9	5	6.6
April	29	14.9	26	6.9
May	3	17.8	31	6.8
June	20	10.3	29–30	5.3
July	24	5.8	11–12	4
August	13	9.2	9	3.4
September	1	3.9	29–30	2
October	1	2.0	24–30	1.2
November	{ 1 & 25–28 }	1.4	3–15	1.2
December	22	*b* 4.9	1–10	*b* 1.3

a May have been lower. River frozen, Feb. 7–17.

b Record from Weather Bureau brass gauge on pier No. 1, Little Rock Free Bridge. Readings from this gauge commenced Dec. 10, 1897.

Arkansas River discharge observations.

[Not printed in previous annual reports.]

Locality where taken.	Date.	Gauge same date.	Area.	Discharge per second.	Lowest gauge during year.	
					Date.	Gauge.
			Sq. feet.	*Cubic feet.*		
Little Rock	Dec. 6, 1886	2.8	3,365	4,365	Nov. 2, 8, 1886	2
Do	Oct. 3, 1887	2.0	7,501	6,601		
Do	Oct. 8, 1887	1.7	7,332	5,279		
Do	Nov. 8, 1887	1.3	7,234	3,111		
Do	Nov. 12, 1887	1.2	7,132	2,639	Nov. 21–23, 1887	1.1
Do	Dec. 7, 1887	10.1	12,180	38,367		
Do	Jan. 2, 1888	2.9	7,832	7,127		
Do	Jan. 13, 1888	4.9	9,055	14,035		
Do	Jan. 17, 1888	5.3	9,200	14,720		
Do	Feb. 4, 1888	8.4	11,403	33,410		
Do	Mar. 6, 1888	9.3	11,983	37,746		
Do	Mar. 9, 1888	11.3	13,869	48,651		
Do	Mar. 28, 1888	14.0	16,038	65,274		
Do	Apr. 9, 1888	5.8	9,337	19,607		
Do	Apr. 19, 1888	13.4	15,610	62,127		
Do	Apr. 14, 1888	16.0	19,010	92,198		
Do	Apr. 16, 1888	16.5	19,845	98,233	Nov. 2–3, 1888	1.9
Do	Apr. 18, 1888	13.2	15,451	65,667		
Do	Apr. 21, 1888	8.2	12,416	34,889		
Do	Apr. 28, 1888	5.3	9,427	16,294		
Do	May 2, 1888	17.0	19,845	98,233		
Do	May 3, 1888	17.5	21,063	105,094		
Do	May 21, 1888	16.8	19,845	99,026		
Do	May 24, 1888	16.7	19,480	92,725		
Do	June 15, 1838	14.9	17,480	71,318		
Do	June 16, 1888	12.7	15,120	52,315		
Do	June 18, 1888	9.6	12,000	31,920		
Do	June 23, 1888	7.9	10,815	21,197		

Arkansas River discharge observations—Continued.

Locality where taken.	Date.	Gauge same date.	Area.	Discharge per second.	Lowest gauge during year.	
					Date.	Gauge.
			Sq. feet.	*Cubic feet.*		
Little Rock	June 27, 1888	15.5	18,189	86,995		
Do	Aug. 18, 1888	2.6	7,607	6,618		
Do	Aug. 29, 1888	3.8	8,130	6,541		
Do	Sept. 4, 1888	12.4	14,050	55,638		
Pine Bluff	Oct. 12, 1892	5.5	2,844	3,839	Oct. 14, 1892	5.4
Do	Nov. 21, 1894	2.4	2,350	3,166	Nov. 26–29, 1894	2.3
Little Maumelle	Nov. 23, 1894	2.4	1,664	2,597		
Newtons Bend	Oct. 12, 1897	1.8	1,438	1,522		
Samples	Oct. 19, 1897	1.5	1,124	1,837		
Greathouse Bend	Oct. 20, 1897	1.4	1,278	1,160	Oct. 24–30, 1897	1.2
Belchers	Oct. 21, 1897	1.4	1,223	1,195	Nov. 3–15, 1897	1.2
Do	Oct. 22, 1897	1.3	1,231	1,190		
Pendletons	Oct. 28, 1897	1.2	735	1,787		
Do	Oct. 30, 1897	1.2	794	1,775		

The observations made in 1887 and 1888 were made by Civil Engineer C. E. Taft for the geological survey of the State of Arkansas. The others were made by assistant engineers employed in this district. The gauge referred to is the "Weather Bureau gauge" at Little Rock, the early records being changed to correspond with the new gauge, established December 1, 1897.

X 3.

IMPROVEMENT OF WHITE RIVER, ARKANSAS.

On page 1668, Annual Report for 1896, is given a statement showing the work done up to that time, and on page 1680 is given the results obtained.

OPERATIONS DURING THIS FISCAL YEAR.

Snag boat Sheldon.—This boat was employed on Black River until the 10th of August. After making repairs it towed the dredge *Van Frank* to Black River Shoal on September 2. It remained with the dredge, being used as a tender, until October 23. When not towing the dredge or getting fuel and supplies to the dredge, the snag boat snagged the river near by. From October 23 to December 24 it worked over the river below Newport. From December 28 to January 3 the boat was used in towing the *Riverside* from Cache River to Newport. It lay here until in March, when it brought the dredge from Batesville. Since then nothing has been done. Three hundred and thirty-three snags were removed, 265 trees cut, and 1 drift broken up between the mouth of the river and Cross Log Shoal (280 miles).

Dredge Van Frank.—This dredge was brought out of Black River on the 10th of August and thoroughly repaired. On September 2 it was towed to Black River Shoal and began working on the shoals of Upper White River. Batesville was reached on December 17, where work was suspended. It was taken to Newport March 14 and laid up with the rest of the White River fleet. The river was low all the time the dredge was at work, and navigation in Upper White River was closed. The cuts made by the dredge were sufficient to give a 3-foot channel for boats 35 feet wide. The pools above the shoals were lowered from three-tenths to five-tenths of a foot, the amount varying with the length of the pool, but in no instance was this lowering sufficient to develop any serious shoals. White River above Jacksonport has been at flood stage twice since the close of work and has not yet reached a low stage, but steamboatmen state that the cuts appear to still be open and no tendency to fill is shown.

Shoals dug over by dredge Van Frank, Jacksonport, Ark., to Batesville, Ark.

Name of shoal.	Length of cut.	Name of shoal.	Length of cut.
	Feet.		*Feet.*
Black River	1,056	Upper Arnolds	146
Black Island	141	Lower Cross Log	406
Upper Black Island	75	Middle Cross Log	363
Rock Boat	520	Upper Cross Log	330
Upper Rock Boat	177	Frys	130
Cravens Chute	125	Saffold	1,484
Upper Cravens	47	Padgetts Island	525
Walls Lake	185	Head of Padgetts Island	524
Haggletooth	669	Magness (5 shoals)	1,541
No name	170	Cato (2 shoals)	627
Do	260	Wrights Island	190
Blue Wing	869	Russeys Ferry (2 shoals)	1,332
Upper Blue Wing ?	259	Rutherfords (3 shoals)	606
Upper Blue Wing	524	Goose Neck	612
Pleasant Island	153	Fatty Bread	585
Head of Pleasant Island	94		
Oil Trough	640	Total length dug	15,810
Arnolds Ferry	445		

Cache River allotment.—The hand-propelled snag boat *Riverside* was towed to Cache River by the snag boat *Sheldon* on the 12th of August and began operations the next day. The *Riverside* had a draft of 11 inches, yet shoal water bothered after the first mile was passed and it was with great difficulty that the boat made any progress. On September 8, at 22 miles up the river, the boat could go no farther and it was temporarily laid up there. A camping party was organized and began operations at Maberrys, working from there down to the boat. The party then went back to Maberrys and worked up to James Ferry, where work was suspended on December 4. By December 28 the river rose enough to allow the *Riverside* to be taken out of the river. The snag boat *Sheldon* met it at Clarendon on December 30 and towed it to Newport, arriving there January 3. By the combined operations of the *Riverside* and the camping party 1,078 snags were removed, 179 trees cut, and 232 trees deadened. The river was rendered navigable by rafts at a 3-foot lower stage. Much work is yet needed.

PLANT.

Repairs.—No extensive repairs were made. Many minor repairs were made to the dredge and to the snag boat *Sheldon*.

Condemned.—Pile Driver No. 188, Store Boat No. 188, Barges Nos. 188, 293, and 393, and old hull of hand-propelled snag boat *Riverside*.

On hand.—Snag boat *Sheldon*, condition good; dredge *Van Frank*, condition good; hand-propelled snag boat *Riverside*, condition good; quarter boat *Albany*, condition bad; and one store boat, condition bad;

Sunk.—Barge No. 493, sunk near Jacksonport.

CHANNEL.

In the early part of the low-water season, before the snag boat reached the lower river, the greatest depth in channel was not available because of snags. During this time 30 inches was reported at Sibley Chute, 23 inches at Little Island, 30 inches at Jerrods Reach. Between Jacksonport and Batesville 18 inches was the available channel depth before the dredging was done. By the operations of the snag boat the 3-foot channel in the lower river was restored, and by the dredging it was extended to Batesville.

Money statement.

July 1, 1897, balance unexpended	$27,494.97
June 30, 1898, amount expended during fiscal year	17,825.52
July 1, 1898, balance unexpended	*9,669.45
July 1, 1898, outstanding liabilities	198.75
July 1, 1898, balance available	9,470.70
Amount (estimated) required for completion of existing project	14,815.00
Amount that can be profitably expended in fiscal year ending June 30, 1900	14,815.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Appropriations for this river have been partly for limited reaches, partly for the whole river, and partly for this river in combination with others. Of the distribution of the expenditures under the latter appropriations I am unable to render any information.

The appropriations for this river separately, and for reaches of it, are as follows:

June 23, 1874	$50,000.00	August 18, 1894		$52,000.00
August 14, 1876	10,000.00	June 3, 1896		22,000.00
March 3, 1879	10,000.00			
June 14, 1880	20,000.00	Total		370,000.00
June 14, 1880	5,000.00	Expended to June 30, 1897	$342,727.25	
March 3, 1881	8,000.00			
August 2, 1882	6,000.00	Less sales and refundments	222.22	
August 2, 1882	4,000.00			
July 5, 1884	35,000.00			
August 5, 1886	18,000.00	Net expenditure to June 30, 1897		342,505.03
August 11, 1888	25,000.00			
September 19, 1890	30,000.00			
July 13, 1892	75,000.00	Unexpended July 1, 1897		27,494.97

COMMERCIAL STATISTICS.

No steamboat has reported navigating the river above Oakland (423 miles above the mouth) during the year ending June 1, 1898. It was navigable to this point December 20 to January 1, January 14 to February 10, and from March 1 to the close of the year. Between Batesville and Jacksonport navigation closed about the middle of October and was resumed in December. Below Jacksonport navigation continued throughout the year.

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*$378.84 for removing obstructions in Cache River, $9,290.61 for White River project.

List of stern-wheel boats navigating White River, Arkansas, May 31, 1897, to June 1, 1898.

Name.	Tonnage.	Draft loaded. Steamer.	Draft loaded. Barges.	Between—	Round trips.	Passengers.
		Ft. In.	*Ft. In.*			
Black Diamond	18	3 0	3 6	Newport and Johnsons	20	60
A. R. Bragg	163	3 6	....	Newport and Pocahontas	40	60
A. Saltzman	36	3 6	3 6	Negro Hill and Judsonia	16	0
Emma	6	4 0	3 0	Devalls Bluff and Des Arc	20	....
F. W. Tucker	145	4 0	....	Newport and Johnsons	36	180
Krata	71	3 2	3 0	Out of Clarendon	12	24
				Out of Newport	4	4
				Newport and Johnsons	7	21
Mary F. Carter	50	3 6	4 0	Clarendon to Little Red River	20	....
				Clarendon to Mississippi	17	70
New Mattie	131	5 0	....	Memphis and points on lower White River.	31	1,159
Ozark Queen	136	3 0	....	Newport and Buffalo City	13	185
				Newport and Sylamore	3	
				Newport and Johnsons	7	40
Portia	50	3 0	4 0	Clarendon and Devalls Bluff	52	120
Rex	144	3 6	3 6	Devalls Bluff and Des Arc	147	559
Tycoon	65	3 0	3 6	Newport and Oakland and intermediate points.	13	125

Classification of commerce reported.

	1898. Value.	1898. Tons.	1897. Tons.	1896. Tons.	1895. Tons.	1894. Tons.
Cotton	$692,480	4,328	3,860	4,693	4,928	3,968
Cotton seed	7,823	979	1,125	1,098	6,721	2,246
Hides and skins	4,575	61	87	37	90	20
Live stock	1,600	40	110	102	101	549
Lumber	32,690	6,538	2,865	2,078	4,619	5,461
Staves and bolts	78,380	21,184	9,359	6,829	5,203	2,772
Provisions	53,440	334	4,302	1,748	8,005	436
Grain	2,670	267	974	725	647	557
Square timber	10,956	1,660	2,840	....	2,750	....
Saw logs	82,076	41,038	14,215	13,188	23,751	21,644
Railroad ties	27,623	10,231	14,690	25,125	13,520	5,940
Cedar	93,000	12,400	15,810	16,800	2,080	....
Miscellaneous freights	327,700	3,277	3,725	2,459	1,344	2,200
Total tons	....	102,337	73,962	74,882	73,759	45,793
Total value (estimated)	$1,415,013	....	$2,435,814	$2,056,991	$2,494,377	$1,043,438

COMMERCIAL STATISTICS OF CACHE RIVER, A TRIBUTARY TO WHITE RIVER.

The last two river and harbor bills have carried provision that some of the money appropriated for improvement of White River may be expended on Cache River. The Cache River reports having been dropped, the commercial statistics of that stream are here embodied as part of the White River report. The snagging operations of this year are reported as making rafting possible on a stage three feet lower than that required before the work was done. The steamer *Iolanthe*, 6 tons, reports making 14 trips from Maberry to the Little Rock and Memphis Railway Bridge, 38 miles below. The steamer *Emma* reports making seven trips from Devalls Bluff to the same bridge.

Classification of commerce reported.

	1898. Value.	1898. Tons.	1897. Tons.	1896. Tons.	1895. Tons.
Saw logs	$14,080	7,040	12,270	7,670	12,186
Railway ties	270	100	....	....	417
Lumber	5,880	1,176	800	44	....
Piling	....	....	940	....	....
Staves and bolts	4,957	1,377	20,980	13,034	....
Miscellaneous freights	11,448	500	....	....	....
Total tons	....	10,193	34,990	20,748	12,603
Total value (estimated)	$36,635	....	$108,460	$62,483	$25,494

X 4.

IMPROVEMENT OF BLACK RIVER, ARKANSAS AND MISSOURI.

The first independent appropriation for this stream was made by act of Congress approved June 14, 1880. On page 1686, Annual Report for 1896, and on page 1975, Annual Report for 1897, is given the work done on this stream since then.

OPERATIONS THIS FISCAL YEAR.

The U. S. snag boat *Henry Sheldon* worked over the river below the mouth of Current River in July and August, and in October made a patrol trip of five days over the same portion of the stream. One hundred and fifty-seven snags were removed, 601 trees cut, and 3 small drifts broken up. No snagging was done between the mouth of Current River and Poplar Bluff.

At Julia Dean Bar.—A dredge was operated at this place for five weeks in July and August. The solid rock bottom was uncovered, but there was no material improvement in the channel, the low-water plane following the bottom down. To maintain a dead low-water channel of 3-foot depth at this place it will be necessary to excavate it from solid rock. To do this it is estimated that $3,500 will be required, which, if appropriated, should be in addition to the $8,000 that can be profitably expended for maintenance during the year ending June 30, 1900.

Dam at head of Big Island.—This dam was begun in July and completed August 13. During the spring high water it was undermined and settled until the crest is at low water. This locality has been called "Head of Dan River" in previous annual reports.

CHANNEL.

Below the mouth of Current River, Spring River Shoal and Julia Dean Bar control the draft of boats. Ordinarily boats of 3-foot draft can be taken over these places all the year, but at extreme low water, such as occurred this year and in May, 1895, the extreme draft is limited to 2.3 feet. I have not been able to inspect this stream between the mouth of Current River and Big Island. It is reported as being in need of snagging up to Gillis Bluff; from there to Poplar Bluff it is in better condition than ever before. Below the mouth of Current River the improvement obtained in fiscal year 1897 has been preserved.

Much rafting is done over the entire length of this stream, and obstructions accumulate rapidly, especially in the upper reaches. That portion of it between the mouth of Current River and mouth of Dan River has not received the attention that has been given to the remaining portions, partly because steamboats do not attempt to run regularly there and partly because the appropriations have not been sufficient to do the work. I estimate that $400 a mile will thoroughly snag the 123 miles of river above the mouth of Current, and that $8,000 will be required annually for maintaining a clear channel from White River to Poplar Bluff, Mo., 269 miles.

Money statement.

July 1, 1887, balance unexpended	$5,204.84
June 30, 1898, amount expended during fiscal year	3,958.04
July 1, 1898, balance unexpended	1,246.80
Amount (estimated) required for work annually	8,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1900, for maintenance	8,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

APPROPRIATIONS.

Appropriations have been made for this stream separately under the head of "Improving Black River, Missouri," and "Improving Black River, Arkansas and Missouri," and also in combination with other rivers. Of the distribution of the expenditures under the latter appropriations, I have no information to present. The appropriations for this river, separately, are as follows:

June 14, 1880	$15,000.00	September 19, 1890	$5,000.00
March 3, 1881	6,000.00	September 19, 1890	7,000.00
August 2, 1882	10,000.00	July 13, 1892	5,000.00
July 5, 1884	20,000.00	August 18, 1894	9,500.00
August 5, 1886	5,000.00	June 3, 1896	8,000.00
August 11, 1888	5,000.00		
August 11, 1888	7,000.00	Total	102,500.00

Expended to June 30, 1897	$101,814.04	
Less sales and refundments	4,518.88	
Net expenditure to June 30, 1897		$97,295.16
Unexpended July 1, 1897		5,204.84

COMMERCIAL STATISTICS.

The river was reported navigable all the year between Poplar Bluff and Corning Mill (62 miles), by boats of 2-foot draft. Below the mouth of Current River the draft during low water was limited to 28 inches at Spring River Bar and Julia Dean Shoal. No steamboat reported navigating the river between the mouth of Current River and Corning Mill, during the year.

The through packet out of Newport for Johnsons Landing, on Current River, is now operated during the cotton season only; at other times the through freights are transferred at Black Rock. This change was made as a business convenience, when the several lines that formerly operated on this river and on White and Current rivers were consolidated under one management.

The commerce of the portion of Black River above the mouth of Current River is that arising solely from lumber and stave industries, and most of it is rafted. Below the mouth of Current River plantation products and supplies, together with timber products, make up the commerce.

List of stern-wheel boats engaged in navigating Black River, Arkansas and Missouri, May 31, 1897, to June 1, 1898.

Name.	Tonnage.	Draft, loaded.				Between—	Round trips.	Passengers.
		Steamer.		Barges.				
		Ft.	In.	Ft.	In.			
Arthur	14	1	4	....		Poplar Bluff and Corning Mill	(?)	220
A. R. Bragg	163	3	6	....		Newport and Pocahontas	40	60
						Black Rock and Johnsons	52	260
Black Diamond	18	3	0	3	6	Black Rock and Johnsons	40	120
						Black Rock and Newport	40	
F. W. Tucker	145	4	0	....		Black Rock and Johnsons	72	360
						Black Rock and Newport	72	
Krata	71	1	6	3	0	Black Rock and Johnsons	14	42
						Black Rock and Newport	14	
Ozark Queen	136	3	0	....		Newport and Johnsons	7	40
Louise	27	3	0	4	0	Towing to Poplar Bluff	287	....
Tycoon	65	3	0	3	6	Towing to Newport	(?)	150

Classification of commerce reported.

	1898.		1897.	1896.	1895.	1894.
	Value.	Tons.	Tons.	Tons.	Tons.	Tons.
Cotton	$178,620	2,977	2,426	2,181	1,473	2,545
Cotton seed	9,790	1,224	1,319	980	6,320	1,524
Hides and skins	....	....	110	60	96	19
Live stock	120	3	125	62	57	59
Lumber	60,835	12,167	10,646	12,912	12,840	9,710
Staves and bolts	64,271	17,856	24,995	5,865	8,171	17,412
Provisions	29,440	184	5,404	1,010	2,694	632
Grain	1,620	162	194	738	495	372
Spokes	....	....	....	....	437	1,780
Saw logs	135,844	67,922	58,880	76,073	83,931	39,300
Railroad ties	23,710	8,782	4,670	7,134	13,441	12,375
Piling	....	....	....	2,400	400	....
Square timber	10,890	1,600	1,360	1,045	1,500	....
Miscellaneous freights	273,500	2,735	1,482	818	578	1,808
Total tons	....	115,612	111,611	111,278	132,433	87,536
Total value (estimated)	788,640	....	$1,704,799	$891,437	$1,085,415	$956,982

X 5.

IMPROVEMENT OF CURRENT RIVER, ARKANSAS AND MISSOURI.

For the original condition of this stream and history of the work see page 1689, Annual Report of the Chief of Engineers for 1896, and page 1978, Annual Report for 1897.

OPERATIONS THIS FISCAL YEAR.

Owing to the limited amount of money available, work was necessarily confined to removing the most dangerous of the obstructions. In July, 1897, the U. S. snag boat *Henry Sheldon* worked over the river from the mouth to Little Black River (32½ miles), and in the last week in October, 1897, it went over the river to Schumachers Ferry (23½ miles). One hundred and sixty-three snags were removed, 1,062 trees cut, and 4 drifts broken up.

Channel.—In fiscal year 1896 snagging operations were carried to a point 11 miles above Doniphan, Mo., and the following were the available channel depths during low water: Mouth to Johnsons Landing, 3½ feet; Johnsons Landing to Little Black River, 2 feet; Little Black River to 11 miles above Doniphan, 16 inches. Since then no snagging has been done above Little Black River, and the channel is again obstructed in the upper reaches—especially so between Little Black River and Current View.

The approved project contemplated the improvement of this stream to Vanburen, Mo., a point 31 miles above the upper limit of work done under present appropriation. This project also contemplated the contraction of water widths at the worst shoals by wing dams. The money expended so far has been expended altogether in removing obstructions from the channel and in cutting overhanging timber. The appropriation of $2,000 in act of June 3, 1896, completes the amount originally estimated as necessary to complete the project. Every rise adds new obstructions to this stream, and it will require about $2,000 a year to maintain the channel already opened up.

Money statement.

July 1, 1897, balance unexpended	$2,318.52
June 30, 1898, amount expended during fiscal year	1,157.26
July 1, 1898, balance unexpended	1,161.26

APPROPRIATIONS.

The early examinations of this river were made under appropriations for this in combination with other streams. The independent appropriations for this stream are as follows:

June 2, 1872, Current River, Missouri		$5,000.00
March 3, 1881, Current River, Arkansas and Missouri		2,000.00
August 18, 1894, Current River, Arkansas and Missouri		8,000.00
June 3, 1896, Current River, Arkansas and Missouri		2,000.00
Total		17,000.00
Expended to June 30, 1897	$14,683.48	
Less refundments	2.00	
Net expenditures to June 30, 1897		14,681.48
Unexpended July 1, 1897		2,318.52

COMMERCIAL STATISTICS.

During the cotton season a weekly packet out of Newport, Ark., plies this stream to Johnsons Landing. After the bulk of the cotton and cotton seed has been moved, the commerce is handled by boats running out of Black Rock, Ark., the through freights being transferred at that point. This change was made after a consolidation of the several steamboat lines operating on this river and on Black and White rivers. A small independent steamer does some business in the vicinity of Current View.

List of stern-wheel steamboats that navigated Current River, Arkansas and Missouri, May 31, 1897, to June 1, 1898.

Name.	Tonnage.	Draft, loaded.		Between—	Round trips.	Passengers.
		Steamers.	Barges.			
		Ft. In.	*Ft. In.*			
A. R. Bragg	163	3 6	....	Black Rock and Johnsons Landing	52	260
Black Diamond	18	3 0	3 6	.....do	40	120
Krata	71	3 2	3 6	.....do	4	20
Ozark Queen	136	3 0	....	Newport and Johnsons Landing	7	15
Current View	(?)	(?)	(?)	No report received	(?)	(?)

Classification of commerce reported, year ending May 31.

Articles.	1898.		1897.	1896.	1895.
	Estimated value.	Tons.	Tons.	Tons.	Tons.
Cotton	$129,920	812	610	719	875
Cotton seed	3,160	395	800	423	550
Lumber	15,240	3,048	380	292	1,026
Staves and bolts	9,932	2,759	920	1,375	4,225
Grain	440	44	20	330	175
Provisions	....	....	2,520	200	540
Saw logs	62,516	31,258	10,070	23,730	13,479
Railroad ties	13,624	5,083	....	1,667	8,333
Square timber	18,084	2,740	1,360	1,045	1,500
Miscellaneous freights	53,300	6,278	398	86	502
Total tons	....	52,417	17,078	29,867	31,205
Total value (estimated)	306,216	....	$581,528	$227,291	$362,447

X 6.

IMPROVEMENT OF ST. FRANCIS RIVER, ARKANSAS.

For statement of projects and previous history of this improvement, see Annual Report of Chief of Engineers for 1896, page 1692, and Report for 1897, page 1980.

OPERATIONS THIS FISCAL YEAR.

The U. S. snag boat *A. B. Johnson* lay at Madison, Ark., until September 2, when it started for the lower river, to be used in making survey of that portion of the stream. The boat arrived at the mouth of L'Anguille River on September 14, and the survey, which was suspended at this point last year, was continued. The survey was completed on the 12th of October and special report made November 6, 1897. (See House Doc. No. 125, Fifty-fifth Congress, second session.) After the completion of the survey the *Johnson* did some snagging, but no effort was made to do thorough work, as the amount of funds available was not sufficient to warrant it. This work was suspended at Black Fish Cut-off, October 30, at which point the boat lay until January 21, on which date it was towed to Madison by the chartered steamer *Rosa*. Nothing has been done since then. One hundred and nine snags were removed and 792 trees were cut by the boat.

Channel.—The basin of this river is low and subject to overflow from the Mississippi river. Its floods and its navigable stages depend upon those of that river. During low water the St. Francis River is not navigable for any considerable distance in any portion of its length. The *Johnson* has a draft of only 12 inches, but it had to be pulled over Cups Crossing, September 3; over Council Bar, September 7; over Fords Bar, September 11; Highbanks Crossing, October 9; Short Bend Crossing, October 14 and 15; and over Fords Bar, October 25 and 26.

Snagging operations have lengthened the navigable seasons about two months, and this is probably the limit of improvement to be obtained by this method. Below Marked Tree the river is in good condition when at 4-foot stage or over, and above Marked Tree a fair high-water channel has been made through the Sunk Lands. In order to preserve the improvement, the entire distance will have to be worked over from year to year, removing the annual accumulation of obstructions.

Money statement.

July 1, 1897, balance unexpended	$3,217.89
June 30, 1898, amount expended during fiscal year	2,544.00
July 1, 1898, balance unexpended	673.89
July 1, 1898, outstanding liabilities	45.00
July 1, 1898, balance available	628.89
Amount (estimated) required for work annually	8,000.00
Amount that can be profitably expended for maintenance in fiscal year ending June 30, 1900	8,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867 and of sundry civil act of June 4, 1897.

APPROPRIATIONS.

The earlier examinations and the earlier operations were made under appropriations for this in conjunction with other rivers. Of the expenditures under these appropriations this office has no record.

The separate appropriations are as follows:

March 3, 1871	$10,000.00
June 14, 1880	5,000.00
July 5, 1884	12,000.00
August 5, 1886	8,000.00
August 11, 1888	4,000.00
September 19, 1890	4,000.00
August 18, 1894	*83,000.00
June 3, 1896	8,000.00
Total	134,000.00
Expended to June 30, 1897	55,782.27
Less refundment	.16
Net expenditures to June 30, 1897	55,782.11
Unexpended July 1, 1897	3,217.89

COMMERCIAL STATISTICS.

The St. Francis River basin was overflowed by the Mississippi River flood of 1897, and the disastrous effect of this is shown in the commercial reports received. The yellow fever outbreak in the fall of 1897 also had a bad effect on business and may be accountable for a part of the decrease in the commerce of this stream.

The river above Marked Tree was reported navigable from December to the close of the year. Below Wittsburg it was navigable in June, 1897, and from January 16, 1898, to the close of the year.

List of stern-wheel boats engaged in navigating St. Francis River, Arkansas, May 31, 1897, to June 1, 1898.

Name.	Tonnage.	Draft, loaded.				Between—	Round trips.
		Steamer.		Barges.			
		Ft.	*In.*	*Ft.*	*In.*		
Fletcher	8	2	0	3	0	Black Fish Cut-off and Tyronza	(?)
Ike	66	2	0	2	6	Short trips out of Lake City	(?)
Jim	13	2	6	2	6	Marked Tree and Lake City	10
Memphis	110	3	0	5	0	Towing to Memphis, Tenn	(?)
Rosa	50	2	6	3	0	Helena and Madison	1
						Helena and Black Fish Cut-off	51
Valentine	17	1	10	2	6	Helena and Raggio	52
Ralph	98	4	6	......		Memphis and Black Fish Cut-off	1
Bonnie	(?)	(?)	(?)	(?)	(?)	No report received	(?)
Edwin	14	1	0	3	0	do	(?)
Clarence E. Long	13	2	6	3	0	do	(?)
Ora Lee	189	5	0	......		do	(?)

Classification of commerce reported, year ending May 31.

Articles.	1898.		1897.	1896.	1895.	1894.
	Estimated value.	Tons.	Tons.	Tons.	Tons.	Tons.
Cotton	$64,320	402	1,740	575	382	125
Cotton seed	11,280	1,410	5,021	731	1,172	60
Hides	560	8	20	3	10	2
Live stock	25,680	642	2,570	300	61	45
Provisions	16,000	100	2,535	751	271	52
Grain	7,880	788	1,650	280	734	43
Railroad ties	3,375	1,250	100	1,670	......	......
Saw logs	19,090	9,545	58,330	51,700	22,000	12,000
Staves and bolts	24,946	6,874	14,512	5,934	7,869	5,860
Lumber	11,350	2,270	10,350	5,690	4,585	1,575
Miscellaneous freights	53,000	530	520	106	1,023	1
Total tons	....	23,819	97,348	67,740	38,107	19,763
Total value (estimated)	$237,481	....	$1,117,891	$401,457	$321,439	$98,375

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* Seventy-five thousand dollars of this, by the conditions of the act, to be expended by the Mississippi Rixer Commission.

X 7.

IMPROVEMENT OF ST. FRANCIS RIVER, MISSOURI.

The first appropriation for this stream was based upon report printed in the Annual Report of the Chief of Engineers for 1887, page 1549.

OPERATIONS THIS FISCAL YEAR.

No improvement work was done. The snag boat used on this stream is owned by the appropriation for improving Arkansas River, Arkansas. The boat became unserviceable last fiscal year. It was cared for by the appropriation owning it until March, 1898, when it was dismantled and the outfit and equipment shipped to Little Rock, Ark.

Channel.—I have not had funds or plant available for inspecting this stream since the last report. Steamboatmen and raftmen report that it is filling rapidly with sunken logs and fallen timber.

Money statement.

July 1, 1897, balance unexpended	*$59.97
July 1, 1898, balance unexpended	59.97
July 1, 1898, outstanding liabilities (estimated)	59.97

APPROPRIATIONS.

This reach of river is understood not to have been included in the snagging operations under the early appropriations for snagging in Western rivers. Its specific appropriations are as follows:

August 11, 1888		$5,000.00
September 19, 1890		10,500.00
August 18, 1894		5,000.00
Total		20,500.00
Expended to June 30, 1897	$23,440.03	
Less sales	3,000.00	
Net expenditures to June 30, 1897		20,440.03
Unexpended July 1, 1897		59.97

COMMERCIAL STATISTICS.

The commerce of this river is that arising solely from lumber and stave industries. The tonnage reported this year is practically the same as that reported last year. Four small steamboats have run this river during the last year. One of them did not make report of the quantity of material transported.

The river was reported navigable from December, 1897, to June, 1898.

List of stern-wheel boats engaged in navigating St. Francis River, Missouri, May 31, 1897, to June 1, 1898.

Name.	Tonnage.	Loaded draft.		Between—	Round trips.
		Steamer.	Barges.		
		Ft. In.			
El Blanco	51	(?)	(?)	Towing to Poplin	(?)
Milt Janes	25	2 7	3 0	do	42
S. A. Stroud	35	2 6	3 6	Towing to St. Francis	(?)
Roy	25	1 8	3 0	Towing to Poplin	(?)

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*Balance shown in Annual Report for 1897 was in error 56 cents. Authority for correction contained in "request for remittance," office Chief of Engineers, August 4, 1896, file mark No. 6223.

Classification of commerce reported.

Articles.	1898.		1897.	1896.	1895.	1894.
	Estimated value.	Tons.	Tons.	Tons.	Tons.	Tons.
Lumber	$13,020	2,604	1,830	700	3,100	3,402
Staves and bolts	6,034	1,676	7,547	9,660	7,106	20,275
Provisions	7,360	46	10	....	50	6
Grain	830	83	45	....	11	180
Miscellaneous freights	2,500	25	49	....	59	160
Spokes	....	....	....	2,100	....	1,901
Saw logs	31,108	15,554	11,714	17,400	12,000	9,882
Piling	6,726	1,221	927	4,762	....	....
Square timber	....	....	110	....		
Railroad ties	5,295	1,961	1,074	875	....	....
Total tons	....	23,170	23,306	35,497	22,326	35,806
Total value (estimated)	$72.873	....	$75,425	$135,029	$79,091	$145,118

In previous years the greater portion of the commerce of this stream centered at St. Francis, Ark.; this year it centered at Poplin, Mo.

This river is crossed near Wappapello by the Cape Girardeau and Fort Smith Railway, at Poplin by the Poplar Bluff and Cairo Branch of the St. Louis, Iron Mountain and Southern Railway, and at St. Francis by the St. Louis Southwestern Railway.

X 8.

SURVEY OF ARKANSAS RIVER AT DARDANELLE, ARKANSAS.

[Printed in House Doc. No. 106, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 2, 1897.

SIR: The river and harbor act of June 3, 1896, in the item making an appropriation for improving Arkansas River, Arkansas and Indian Territory, provides:

> That the Secretary of War may, in his discretion, cause examinations and surveys to be made at or near * * * Dardanelle, * * * to determine whether or not, by reason of dikes or other Government works, any part of the harbors or river banks in their vicinity have been so injured or endangered that the Government should guard against or remedy the same.

The survey thus provided for was assigned to Capt. W. L. Sibert, Corps of Engineers, and I have now the honor to submit the accompanying copy of report of October 26, 1897, with map,* by that officer of the results. Captain Sibert expresses the opinion that the dikes constructed by the United States above the town of Dardanelle have not so injured or endangered the harbor or river banks in their vicinity that the Government should guard against and remedy the same, and he therefore recommends that the bank in question be not protected.

In forwarding the local officer's report, Col. Henry M. Robert, Corps of Engineers, division engineer, concurs in the opinion of Captain Sibert that the bank in question should not be protected by the United States.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

HON. R. A. ALGER,
Secretary of War.

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*Not reprinted. Printed in House Doc. No. 106, Fifty-fifth Congress, second session.

REPORT OF CAPT. WM. L. SIBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Little Rock, Ark., October 26, 1897.

GENERAL: I have the honor to submit the following report on survey of Arkansas River at Dardanelle, Ark., as provided for in river and harbor act of June 3, 1896, as follows:

> The Secretary of War may, in his discretion, cause examinations and surveys to be made to determine whether or not, by reason of dikes or other Government works, any part of the harbors or river banks in their vicinity have been so injured or endangered that the Government should guard against or remedy the same.

The only caving bank in the vicinity of Dardanelle is on the Dardanelle side of the river; commences about 1,000 feet below Cox's wharf and extends about 2 miles down the river. The question at issue is, Do the dikes X, built in 1894, and Y, built in 1889, and the paved old steamboat wharf on the left bank above the town of Dardanelle, paved in 1894, cause the caving of the bank in question to the extent contemplated in river and harbor act of June 3, 1896?

No surveys have been made of the caving bank, so far as I can ascertain, since 1869 prior to that submitted herewith, and the absolute rate of caving before and after the construction of the dikes above town can not be determined. If the absolute rate of caving were known, the varying nature of the material composing the bank caved in from year to year would still be an unknown quantity in the discussion.

On March 23, 1894, Capt. Carl F. Palfrey submitted a report to the Chief of Engineers concerning the caving of this bank. He obtained an approximate bank line of 1889 by intersection of section lines with this bank, but no copy of the sketch submitted can be found in this office. However, he clearly states that by comparing the lines of 1869, 1889, and 1894, the caving is shown to be continuous and practically regular. * * *

Besides this report the only evidence in the case is that of individuals living along the bank. While of course they have kept no record of the rate of caving, those questioned stated that the bank had been caving all the time for the last twenty-five years. It will be noticed that the head of the bar on the side of the river opposite to this caving bank is composed of heavy gravel. This, in my opinion, has been very instruumental in holding the channel against the bank in question since 1869.

On the left bank it will be seen that dikes X and Y and the protected old steamboat wharf have been sufficient to practically arrest caving since 1894. It will be noticed that the caving of this bank since 1869 has been a slow process. This bank is a heavy loam mixed with clay, and had, in my opinion, nearly reached a shape where caving would have been very slight, else it is probable that the low dikes with their slight bank protection would not have stopped the erosion. The upper dike is built to a 6-foot stage, the lower to a 7.5-foot stage.

The old steamboat landing is not a dike, but merely a paved slope, repaired by the United States in 1894.

In my opinion, the dikes constructed by the United States above the town of Dardanelle have not so injured or endangered the harbor or river banks in their vicinity that the Government should guard against or remedy the same, and I would therefore respectfully recommend that the bank in question be not protected.

Very respectfully, your obedient servant,

WM. L. SIBERT,
Captain of Engineers.

Brig. Gen. JOHN M. WILSON,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

U. S. ENGINEER OFFICE,
SOUTHWEST DIVISION,
New York, October 30, 1897.

Respectfully forwarded to the Chief of Engineers, United States Army. I concur in the opinion of Captain Sibert that the bank in question should not be protected by the United States.

HENRY M. ROBERT,
Colonel, Corps of Engineers, Division Engineer.

X 9.

SURVEY OF ST. FRANCIS RIVER, ARKANSAS, WITH A VIEW TO AFFORDING SLACK-WATER NAVIGATION UP TO WITTSBURG, AND TO MARIANNA, ON L'ANGUILLE RIVER.

[Printed in House Doc. No. 125, Fifty-fifth Congress, second session.]

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 1, 1897.

SIR: I have the honor to submit the accompanying report of November 6, 1897, with maps,* by Capt. W. L. Sibert, Corps of Engineers, upon the results of a survey of St. Francis River, Arkansas, for improvement by locks and dams to give slack-water navigation from its mouth to Wittsburg, and to Marianna on L'Auguille (L'Anguille) River, its tributary, made to comply with requirements of the river and harbor act of June 3, 1896.

Captain Sibert presents a plan for improvement by construction of an 18-foot lift lock and fixed dam at Rock Bar on the St. Francis to secure slack water at Marianna, and an additional lock and dam with 15-foot lift to continue slack water to Wittsburg, the estimated cost, including dredging at the mouth and contingencies, being $659,770, but he states that in view of the character of material composing the banks and bottom of the Lower St. Francis it would be an extremely doubtful experiment to try to maintain a fixed dam with a lift of 18 feet at Rock Bar, and that, in his opinion, it is impracticable to make slack-water navigation to Marianna on L'Anguille River.

A second plan, eliminating that part of the project providing for slack water to Marianna, is proposed by Captain Sibert with a view to obtaining 3-foot navigation to Wittsburg at low water by construction of three locks with movable dams, the estimated cost of which, including dredging at the mouth and contingencies, is placed at $980,720.

Captain Sibert further states that—

> A large portion of the St. Francis Valley is liable to overflow by the Mississippi River, which fact retards its development. On account of this and the cost of the proposed work in comparison with the commerce likely to be developed, I am of the opinion that the river is not worthy of improvement by locks and dams at the present time.

Very respectfully, your obedient servant,

JOHN M. WILSON,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. R. A. ALGER,
Secretary of War.

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*Not reprinted. Printed in House Doc. No. 125, Fifty-fifth Congress, second session.

REPORT OF CAPT. WM. L. SIBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Little Rock, Ark., November 6, 1897.

GENERAL: I have the honor to submit the following report on survey of St. Francis River, Arkansas, made with a view of determining the practicability of improving the river by locks and dams to give slack-water navigation from its mouth to Wittsburg, and to Marianna, on L'Anguille, its tributary, as provided for in river and harbor act of June 3, 1896.

This survey was made by P. R. Van Frank, jr., assistant engineer, whose report is inclosed herewith, and to which attention is invited for details.

The following tracings are inclosed:

Tracing of map showing meander and depths from mouth to mouth of L'Anguille.

One sheet borings, and one sheet showing profile from mouth to mouth of L'Anguille.

The survey gives the following data:

Difference in elevation between low water at mouth of St. Francis and low water at Wittsburg, 30 feet.

Difference in elevation between low water at mouth of St. Francis and low water at Marianna, on L'Anguille, 15.2 feet.

Low-water discharge at St. Francis near mouth, 915 cubic feet per second.

Low-water discharge of L'Anguille, 65 cubic feet per second.

Low-water discharge of St. Francis at Madison, Ark., gauge 0.2 feet, 505 cubic feet per second.

The above low-water discharges are the low-water discharges for this season only.

In considering the question of improving this stream by locks and dams, it must be assumed that provision will be made for removing annually the bar at its mouth by dredging. It is estimated that 33,550 cubic yards, approximately, will be the amount of dredging annually. If the dredging plant in use on the Mississippi River does this work, the annual cost will probably not exceed $1,680.

About the only location for the first lock of a system is at Rock Bar. With the bar at the mouth of St. Francis dredged out, it is assumed that the low-water elevation in the St. Francis at the foot of Rock Bar will be practically the same as at the mouth, consequently a lock located at Rock Bar should have a lift of 18 feet to give a navigable depth of 3 feet to Marianna, on L'Anguille River. The low-water discharge of L'Anguille River being only 65 cubic feet per second, a pool in that stream sufficient for navigation could not be maintained by a dam across the stream itself, hence the only way to provide slack water at Marianna is to make the dam at Rock Bar of sufficient height for St. Francis River water to form the pool to Marianna, viz, 18 feet.

A lift of 18 feet is greater than that usually adopted in the canalization of streams in this country, although there are a few instances where such a lift has been adopted.

A dam with a lift of 18 feet at Rock Bar being the only way to give slack water to Marianna, the next point for consideration is, shall the dam be fixed or movable.

While the St. Francis River itself carries very little silt, due to the fact that the Sunk Lands act as a settling basin for the water coming from the hills of Missouri, the Mississippi River water, during overflows, entering the St. Francis Basin, carries with it some of its silt. The amount of this silt would be a difficult point to determine. If the Mississippi water at Rock Bar were always backwater, no fear of hurtful deposit need be entertained above a fixed dam at that place.

Col. Charles R. Suter, Corps of Engineers, in his report of May 6, 1894, concerning the probability of the Mississippi River cutting through the space dividing it from the St. Francis in the vicinity of Walnut Bend, Ark., states concerning the St. Francis that: "Its level at the lower end, therefore, depends very largely on backwater from the Mississippi, except when heavy rains are running off or when the overflow water reaches its channel from the Mississippi at points below New Madrid. At such times it may be higher than the trunk stream and discharge into it over the intervening bank."

When the level of the St. Francis water surface, at or near its mouth, is equal to or higher than the level of the water surface in the Mississippi during floods, the consequent current in the lower St. Francis would be checked by a fixed dam at Rock Bar and cause a filling of the pool with Mississippi River sand, etc., to some extent at least. This condition does exist at times, and the deposit during these times would not be removed by subsequent rises with a fixed dam in the river. The following observed facts concerning the movement of sand in this stream are quoted in this connection from Mr. Van Frank's report:

> Beginning at the head of Egg Bar and continuing three-fourths of the way down it, there was, in September and October of this year, a succession of sand ridges which were evidently sand waves when the river was at high stages. These ridges have the steep slope on the downstream side, showing they were made by the St. Francis River current. These ridges near the water are as high as 4 and 5 feet above the intervening hollows; going back from the water this difference decreases until a 20 or 22 foot stage is reached, where the bar is smooth. On the lower quarter of the bar these sand waves do not appear and the bar has grass growing on it to as low as a 15-foot stage. Farther upstream on this same bar grass is found in many of the hollows between the sand ridges, showing that these ridges were made during the last high water. On the bar above Egg Bar the sand ridges are not so high, and on the little bar 1½ miles above the mouth of river they are small.
>
> The left bar in Madison Bend shows large sand deposits made lately, the sand ridges being 6 to 7 feet high. On the low bar 1 mile above Madison the sand ridges are from 1 to 2½ feet high. These references show that there is at times enough sediment brought into the river to affect it locally.

The condition described on the above bars is considered typical.

The height of these sand waves indicates a considerable movement of sand, and it is probable that in a few years the upper end of the pool would be filled to such an extent as to destroy its efficiency.

The banks of the Lower St. Francis are what are ordinarily termed sliding banks and are composed of alternate layers of sand and mud. The bottom is composed of alternate layers of sand and mud to a depth of about 24 feet, where a compact gravel is found of varying thickness. With this character of material composing the banks and bottom, it would be, in my opinion, an extremely doubtful experiment to try to maintain a fixed dam with a lift of 18 feet at Rock Bar.

Assuming it possible to build and maintain such a dam, it would require an additional lock and dam with a lift of 15 feet to provide slack water to Wittsburg.

Estimate for locks and fixed dams, from the mouth to Marianna and Wittsburg.

	One lock, 18-foot lift.	One lock, 15-foot lift.
Lock	$150, 285	$127, 375
Dam	*a* 114, 975	*b* 85, 725
Abutment	21, 700	19, 400
Detail survey	1, 500	1, 500
Lock houses and grounds	12, 000	12, 000
Total	300, 460	246, 000

a 750 feet.

b 675 feet.

Dredging at mouth	$1,680
Lock and fixed dam (18 foot lift)	300,460
Lock and fixed dam (15-foot lift)	246,000
Contingencies	111,630
Total	659,770

While this estimate is submitted, it is my opinion that the plan is impracticable. Assuming it so, the only alternative for providing slack water at Marianna is a movable dam with lift of 18 feet at Rock Bar.

Assume such a dam with a navigable pass 160 feet wide, one weir 160 feet long with movable parts 10 feet high and one 160 feet long with movable parts 8 feet high, and the remainder of the river closed with fixed dam, and compare the leakage reduced by covers as much as practicable with the recorded leakage through Dam No. 5, Great Kanawha River, and it is seen that it would require a low-water discharge of about 1,650 cubic feet per second to supply the leakage, while the low water discharge of the river is 915 cubic feet per second.

It is therefore concluded that it is impracticable to make slack-water navigation to Marianna on L'Anguille River.

With the part of project providing for slack-water navigation to Marianna eliminated, the next question is the practicability of providing slack water to Wittsburg.

To provide 3-foot navigation to Wittsburg at low water it will be necessary to overcome a difference in elevation of 33 feet by locks and dams. This would require three locks, with movable dams, with lifts of about 11 feet each, fixed dams being eliminated for reasons given above.

The distance from the mouth of St. Francis to Wittsburg is about 99 miles.

Estimate for locks with movable dams giving slack water to Wittsburg, Ark.

LOCK AND DAM NO. 1.

[Lock 36 by 160. Dam consists of four parts, viz, one pass (with 12-foot needles) and pier 160 feet; one weir (with 8-foot needles) and pier 160 feet; one weir (with 5-foot needles) and pier 160 feet, and 270 linear feet of fixed dam. Estimated leakage, 735 cubic feet per second. Low-water discharge, 915 cubic feet per second.]

Estimate.

Lock	$104,465
Pass	43,410
8-foot weir	40,135
5-foot weir	43,715
Fixed dam	27,270
Abutment	17,120
Detail survey	1,500
Lock houses and grounds	12,000
	289,615
Contingencies, 20 per cent	57,922
Total	347,537=$347,540

LOCK AND DAM NO. 2.

[Lock 36 by 180. Dam of four parts, viz, one pass (with 12-foot needles) and pier 160 feet; one weir (with 8-foot needles) and pier 135 feet; one weir (with 5-foot needles) and pier 135 feet, and 220 feet of fixed dam. Total length of dam, 650 feet. Estimated leakage, 670 cubic feet per second. Low-water discharge, 710 cubic feet per second—mean of discharge at mouth and Madison.]

Estimate.

Lock	$104,465	
Pass	43,410	
8-foot weir	36,115	
5-foot weir	39,280	
Fixed dam	22,220	
Abutment	17,120	
Detail survey	1,500	
Lock houses and grounds	12,000	
	276,110	
Contingencies, 20 per cent	55,222	
Total	331,332	=$331,330

LOCK AND DAM NO. 3.

[Lock 36 by 180. Dam of three parts, viz, one pass (with 12-foot needles) and pier 134 feet; one weir (with 5-foot needles) and pier 210 feet, and 206 feet of fixed dam. Total length of dam, 550 feet. Estimated leakage, 505 cubic feet per second. Low-water discharge, 505 cubic feet per second.]

Estimate.

Lock	$104,465	
Pass	35,960	
5-foot weir	58,285	
Fixed dam	20,810	
Abutment	17,120	
Detail survey	1,500	
Lock houses and grounds	12,000	
	250,140	
Contingencies, 20 per cent	50,028	
Total	300,168	=$300,170

For slack water from mouth to Wittsburg by locks and dams.

Dredging at mouth (33,550 cubic yards, at 5 cents)	$1,680
Lock and Dam No. 1	347,540
Lock and Dam No. 2	331,330
Lock and Dam No. 3	300,170
Total	980,720

Within the year ending May 31, 1897, there was 4-foot navigation for seven months to Wittsburg, and the following was the reported commerce:

Articles.	Tons.	Value.
Cotton and cotton seed	2,975	$108,720
Live stock and hides	1,110	45,100
Lumber, staves, and railroad ties	5,100	20,090
Grain, provisions, and miscellaneous	1,125	118,200
Saw logs	14,330	28,660
Total	24,640	320,770

The actual commerce carried on a stream is often no measure of the benefit done a community by that stream. The stream should be credited with the reductions that it causes railroads to make in freight rates.

It should be noted that 19,430 tons of the 24,640 tons reported commerce is some form of timber, an industry that will after a time decrease.

The time of year when there is no water in the river is the time when the principal agricultural product of the St. Francis Valley, viz, cotton, is marketed.

A large portion of the St. Francis Valley is liable to overflow by the Mississippi River, which fact retards its development. On account of this and the cost of the proposed work in comparison with the commerce likely to be developed, I am of the opinion that the river is not worthy of improvement by locks and dams at the present time.

Very respectfully, your obedient servant,

Wm. L. Sibert,
Captain of Engineers.

Brig. Gen. John M. Wilson,
Chief of Engineers, U. S. A.

REPORT OF MR. P. R. VAN FRANK, JR., ASSISTANT ENGINEER.

Little Rock, Ark., *November 6, 1897.*

Captain: I have the honor of reporting the completion of survey of St. Francis River, Arkansas, to determine the practicability of improving this river by locks and dams, to give slack-water navigation from its mouth to Wittsburg and to Marianna, on L'Anguille River, its tributary. The work done was that of connecting low-water marks at Wittsburg, Madison, Marianna, and the mouth of St. Francis River by a duplicate line of Wye levels; taking soundings from the mouth of St. Francis River to the mouth of L'Anguille River, and making a few borings at the first two shoals above the mouth of St. Francis River. The levels connecting low-water marks at Wittsburg, Madison, and Marianna were run in November and December of 1896. They did not follow the river, but went over the wagon roads and the railroads connecting the places mentioned. The rest of the work was done in September and October of this year. The borings were made with water jet and driven pipe. The drivepipe used was 1½ inches; the jet pipe was one-half inch. The drivepipe was not large enough for work in the compact gravel at head of Browns Bend. For this class of work 2½-inch pipe should be used until it refuses to go, then 1½-inch pipe can be driven inside of it after a hole is drilled or jetted ahead.

From the levels the following elevations are obtained:

	Feet.
Low water at Wittsburg	191.5
Low water at Madison	186.2
Low water at Marianna	176.7
Traditional low water at mouth of L'Anguille	165.3
Bottom of river at High Banks Crossing (October 6, 1897)	166.2
Bottom of river at Rock Bar (September 27, 1897)	163.0
Low water at mouth of St. Francis River	161.5

The elevations given refer to Cairo datum, 13.13 feet having been added to the elevation given in Annaul Report Chief of Engineers, Part VI, page 2548, for elevation of T. B. M. No. 129, on which these levels closed. The elevation of low water at mouth of St. Francis is approximated from gauge readings on the Mhoon and Helena gauges.

The first bar to obstruct low-water navigation in the St. Francis River lies directly in its mouth. The situation of it prohibits the building of lock and dam to give slack-water navigation over it. This bar is a mud and sand deposit from the Mississippi River, through which the St. Francis forces a narrow channel with steep slope. On September 24 the fall at this place was 1.6 feet; the channel width in narrowest place was 100 feet; the channel depth was 2 feet over two reefs. In the line of the channel, at depth of 4 to 6 feet below the bottom, sand is found under the mud.

This bar can be dredged to the required depth and width for low-water navigation without any injury to the channel between the mouth and Rock Bar, which is 5½ miles up the river at Blue Point Landing. During low water of 1895, 18 inches was the depth in the channel over Rock Bar. It is a gravel ridge that comes out of the left bank one-half mile above the landing and goes into the right bank one-fifth of a mile below it. The lowest point in this ridge is 1½ feet higher than low water at the mouth of the river.

The next shoal is at High Banks Crossing. This is sand. There are no shoals between High Banks Crossing and the mouth of L'Anguille River.

Borings were made near Rock Bar and near High Banks Crossing. Seven borings were made at the first-named place. Four of these made close to it show sand, river mud, and sand and gravel in alternating layers to a depth of 20 to 24 feet below low water. At this depth is a bed of compact gravel varying in thickness from 1 foot to over 3 feet. Under this gravel in boring No. 5 for a depth of more than 7½ feet is a blue clay, free from grit and of putty-like consistency. Above the compact gravel the firm blue mud varies from 12 feet to 1 foot.

There is at some places only one layer of it; at others there are as many as four layers. The depths to this mud and distances between layers are very irregular. The sand strata vary in thickness from one-half foot to 11 feet. Two borings (900 to 1,100 feet downstream from the others) show compact gravel at 21 to 22 feet below low water; thickness of layers from three-fourths of a foot to one-fourth of a foot. The blue clay is found at 24 to 26 feet below low water. Thickness of blue clay is unknown. Boring No. 7 went into it 10 feet. Boring No. 4 is not shown on the sheet of borings. In this one, at a depth of 12½ feet, a sound oak log was found. In boring No. 6, at 21.9 feet, wood was found. This, apparently, is sunken driftwood, as the discharge from the pipe brought up pieces of twigs and one cockleburr. Three borings were made near High Banks Crossing. About the only difference between the nature of the river bed here and near Rock Bar was the absence of the compact gravel. Firm blue clay was reached at depths varying from 24 feet below low water to 34 feet below.

The banks of St. Francis River below the mouth of L'Anguille are high, with very few swales or low places. They average about 40 feet above St. Francis River ordinary low water. They are of blue clay and sand in alternating layers. Thickness of layers is very irregular; sometimes the bank is nearly all clay, at others nearly all sand. Only at one place was any gravel noticed, and this was in the left bank where the gravel ridge before mentioned comes out of the bank. At the foot of High Banks Bend is a small, low gravel bar lying along the right bank. Slipping banks are numerous. They are, with very few exceptions, present on either side of the river and frequently on both sides. The slipping is caused by the sand moving from between the layers of clay. The whole country is apparently saturated with water during overflow stages of the Mississippi, and this ground water, flowing back to the river when it is low, moves the sand. There is not much difference on either side of the river in the amount of water thus coming in. In different localities the quantity will vary from just enough to moisten the bank to streams half the size of one's wrist. The left bank of the river in vicinity of Blue Point Landing, excepting the point proper, is one of the banks that is principally sand and does not show any tendency to slip. It would be eroded easily by any current. The point proper is clay and has slipped some this year. The right bank opposite and below the bar is clay and sand. A considerable quantity of water seeps out of this bank, and it did a little slipping while the borings were being made in this vicinity. The bars in this river do not change rapidly and, excepting those banks held by the bars, I do not remember of seeing a bank below the mouth of L'Anguille River that does not show signs of slipping now or of having slipped at some past date.

The St. Francis River is not a silt-bearing stream, but some sand is brought into it by the Mississippi flood waters. Between Blue Point Landing and the mouth of L'Anguille there are two sand bars, one (the lower one) known as Egg Bar, the other name, if any, unknown. High Banks Crossing is the sand ridge connecting these bars. Beginning at the head of Egg Bar and continuing three-fourths of the way down it, there was, in September and October of this year, a succession of sand ridges, which were evidently sand waves when the river was at high stages. These ridges have the steep slope on the downstream side, showing they were made by the St. Francis River current. These ridges near the water are as high as 4 and 5 feet above the intervening hollows. Going back from the water this difference decreases until a 20 or 22 foot stage is reached, where the bar is smooth. On the lower quarter of the bar these sand waves do not appear and the bar has grass growing on it to as low as a 15-foot stage. Farther upstream on this same bar grass is found in many of the hollows between the sand ridges, showing that these ridges were made during the last high water. On the bar above Egg Bar the sand ridges are not so high, and on the little bar 1½ miles above the mouth of the river they are small.

High Banks Crossing and the foot of High Banks Bend were in bad shape. The difference between elevations of water surface in High Banks Bend and Egg Bar Bend was 2 feet October 9, 1897. In the foot of High Banks Bend was one rolling sand reef and on the crossing were two. Over the lower reef the water depth was only 12 inches. The overseer on the United States snag boat *A. B. Johnson* stated that he found less water on the crossings between Madison and the mouth of L'Anguille in September of this year than he found in the fall of 1894, when the Madison gauge read 1.6 feet lower. He found many of the bends had as little channel depths as the crossings below. The left bar in Madison Bend shows large sand deposits made lately, the sand ridges being 6 to 7 feet high. On the low bar 1 mile above Madison the sand ridges are from 1 to 2½ feet high. These references show that there is at times enough sediment brought into the river to affect it locally. Whether or not this occurs during each overflow season I can not say. How much of this sediment, if any, is taken into the Mississippi by local rises in the St. Francis I have no way of estimating.

Discharge observations were made as follows (in cubic feet per second):

St. Francis River at foot of High Banks, October 9, 1897	915
L'Anguille River, three-fourths mile above the mouth, October 12, 1897	65
St. Francis River, Madison, Ark., November 1, 1897 (Madison gauge, 0.2)	505

Madison gauge has been as low as —0.4, but at that time there was as much water in the channel below Madison as when this discharge was taken, so I believe this is a fair low-water estimate for this part of the river. But I think that the discharge observed at High Banks is a large low-water value. All, or nearly all, the shoals above the mouth of L'Anguille were above their normal elevation, and so far as could be learned by inquiry were being washed down. This action would release the ponded waters and give a larger flow than would be after the shoals are lowered to their normal height and the natural pools reduced to their average size.

As to the commerce to be benefited by the improvement, I do not know of any further than that given in the Annual Reports. With slack-water navigation on St. Francis there would probably be river and rail competition to all towns near the river. While these towns would thus get the benefit of slack-water navigation, all the freights would not pass over the river. That there would be some increase in river commerce there can be no doubt, for now during the time that plantation products (cotton and cotton seed) are being marketed the river is not navigable and these products are teamed to some railway point or to the Mississippi River for shipment. In tons the greater part of St. Francis River commerce is now made up of timber, in either the form of saw logs or rough staves and bolts. The commerce of the river, as given in the Annual Reports, includes all of it as far up as Kennett, Mo. (about 279 miles), while the contemplated improvement will benefit about 95 miles of the lower river and some of the streams coming into it below Madison, of which L'Anguille River, Cow, Blackfish, and Alligator bayous are the principal ones. The river commerce below Wittsburg for the year ending May 31, 1897, is given below. This is made up from reports received from parties using the river. It is not complete, as some of the parties failed to send the requested information.

Articles.	Tons.	Value.
Cotton and cotton seed	2,975	$108,720
Live stock and hides	1,110	45,100
Lumber, staves, and railroad ties	5,100	20,090
Grain, provisions, and miscellaneous	1,125	118,200
Saw logs	14,330	28,660
Total	24,640	320,770

For seven months of this time there was sufficient water for 4-foot navigation to Wittsburg.

I am, sir, very respectfully, your obedient servant,

P. R. VAN FRANK, JR.,
Assistant Engineer.

Capt. WM. L. SIBERT,
Corps of Engineers, U. S. A.

A summary of commercial statistics of towns along and near St. Francis River for the year 1896.

[Furnished by boards of trade or committees of merchants.]

		Quantity.	Value.
EXPORTS.			
Cotton	bales	61,395	$2,223,825
Cotton seed	tons	28,380	228,780
Corn	cars	41	182,800
	bushels	580,000	
Potatoes	bushels	231,100	74,200
Cattle	cars	16	98,000
	head	*a* 8,200	
Hogs	head	*a* 8,300	41,200
Hay and oats	cars	20	2,000
Hides and furs		174,000	55,000
Other farm products			3,000
Lumber	cars	951	219,750
	feet	120,500,000	1,005,000
Staves and heading	staves	5,000,000	750,000
	cars	1,990	597,000
Railroad ties		1,704,000	390,800
Timber	cars	10	1,000
	feet	23,200,000	980,000
IMPORTS.			
Merchandise of all kinds			2,805,000
Total			9,657,355

a Cattle and hogs and sheep much greater than this amount are marketed by driving through the country, lacking shipping facilities.

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